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pack the apparatus and collections, intending to sail on August 17th, but the plans were interrupted by the sickness of Prof. Humphrey, who died on August 17th at Port Antonio. The gravity of his case was not appreciated by the doctors until a few hours before the end which came with terrific rapidity. Mrs. Humphrey, who was with him, did not know that his condition was even serious until she was informed by the doctors that he was dying.

Mr. Fredholm, who is familiar with tropical diseases, urged Conant and Clark to entrust Mrs. Humphrey to his care, and to leave the island by a steamship which started that night; but they refused, choosing rather to remain with her until they could accompany her to her home and leave her among friends, but before she was able to leave the island Clark himself contracted the disease, and while the attack was slight and soon over, he and Conant were delayed until September 6th. After Fredholm had seen all the members of the party embarked for home, and after most of the white residents had deserted Port Antonio, he himself sailed for Baltimore, which he reached in good health September 20th, to hear on landing that Conant had been taken ill on the second day at sea, and that while he had reached Boston alive on Sunday, September 12th, he had died the next day at the Massachusetts General Hospital. All the other members of the party have been and are still in good health.

Prof. Humphrey, who was much interested in the study of the vegetable cell, and in the changes that accompany fertilization and cell division, has left many notes upon these subjects; and he also collected in Jamaica much valuable embryological material for the study of cytological problems in algae, in the palms, and in plants belonging to the pepper and ginger families. It is to be hoped that this material, which was collected at such great cost, may be used by other botanists, as it would have been used by him had he lived, to increase our knowledge of fundamental biological problems, and that some of his own unfinished notes may thus be supplemented and prepared for publication.

Dr. Conant revisited Jamaica last summer to continue studies which he had begun at Port Henderson in 1896, upon a rare group of jelly-fish, the Cubomedusae, of which he had discovered in Jamaica two new species; one of them a representative of a new family.

He devoted last winter to the anatomical and histological study and the systematic description of these species, and his work on the Cubomedusae, which is complete and fully illustrated, was accepted, in June last, as a thesis for the degree of Ph. D.

As this work showed that the eyes of these jelly-fish present favorable conditions for studying the action of retinal pigment-cells under the influence of light and darkness, he returned to Jamaica to study the physiology of vision in the Cubomedusae, and he brought home notes and preserved specimens which will in time enable some one else to complete this work, and to furnish a supplement to Conant's thesis.

It has fallen to me to tell the story of the expedition to Jamaica and its tragical end, and it has seemed best to do this in a bald outline, and to omit the sad details. The accounts of the life and character and work of Prof. Humphrey and Dr. Conant, which will be prepared by others, will show what all who knew these men are only too well aware of,—the loss which science and liberal culture have sustained through their untimely death; for each had enriched the literature of science by contributions which, while of permanent value in themselves, gave promise of still more valuable additions yet to come. The loss has fallen with especial severity upon this University and upon its biological department, where both Humphrey and Conant had inspired all who met them with their own earnest and single-minded devotion to the cause of truth.

It is inexpressibly sad to read now my last letter from Dr. Conant, from which I copy the following passage. "Dr. Humphrey had managed the laboratory in a way that deserved the highest praise. From the very first week I began to respect and admire him more than ever before, and my admiration grew steadily up to the very last. It is beautiful, conscientiously to say nothing but good concerning the dead,—to feel that one has not to overhaul the truth and make it presentable. In this case the honest plain-spoken truth is praise in and of itself." I can only add that the truth in itself, if it could be made clear to those who did not know Conant, would be the highest praise that one could give to him, for no one could have proved himself a brighter example, in all the relations of life.

My own acquaintance with Humphrey and Conant was not restricted to formal intercourse in the laboratory, for I had learned to count them among my warmest friends, and to look forward with pleasure to our meetings in the field and at the sea-shore, where conversation was often led to subjects which are not commonly held to be within the province of science. My most vivid remembrance of both is their earnest and fearless devotion to truth, for while each found in his own nature convictions which seem hard to reconcile with mechanical conceptions, each was firmly convinced that the knowledge of nature is too beneficial and wholesome to end in anything but good. Each has assured me, in one form of words or another, of his conviction, that the solution of these difficulties is to be sought in more and better knowledge of nature; and in the strength of this conviction each was prepared to make the search for truth the business of his life, even if rewards should be scanty or recognition long in coming, and to count everything else as unworthy to be compared with the advancement of the knowledge of nature.

I do not believe that any danger, however great or imminent, could, for an instant, have shaken this calm and settled purpose; for there is no one among us who is more convinced than they that, "The heart of him that hath understanding getteth knowledge. She is more precious than rubies; and all the things thou canst desire are not to be compared unto her."

The Viviparous Synapta of the West Indies.

By Hubert Lyman Clark, Fellow of the Johns Hopkins University.

(Reprinted from the *Zoologische Anzeiger*, No. 512, 1896.)

During the past few months, I have had the opportunity of studying the anatomy and development of a viviparous Synapta, found in Kingston Harbor, Jamaica, very probably the species which Oersted described in 1850, under the name of *Synaptula vivipara*. At the present time Oersted's species is one of the Synaptidae about which little or nothing is known; it is so considered by Théel in his systematic review of the Holothurioidea in the "Challenger Report" (Vol. XIV, Part XXXIX, page 32). It is hoped that the following description will serve to define the species and give it its proper place in the group.

External Characters: Length from five to fifteen centimeters; diameter from three to five millimeters. Tentacles twelve, rarely thirteen, long and slender; sometimes one or two are longer or shorter than the others; digits from 25 to 37, the older the animal, the greater the number. Surface of the body very rough owing to the anchors in the skin. Color reddish—or greenish—brown of various shades, usually rather dark and often with numerous white spots, due to aggregations of miliary granules. Body semi-transparent, the longitudinal muscles and the intestine showing plainly.

Internal Anatomy: Alimentary canal long and slender, with a single simple convolution and somewhat enlarged to form the cloaca. Haemal system simple but well-developed. Calcareous ring narrow, of 12-13 pieces, five of which are pierced for the nerves; each piece is simple without posterior prolongations of any kind. Cartilaginous ring present, directly beneath, and of the same width as the calcareous ring. Water-vascular ring a little below the cartilage, with from two to seven polian vesicles of various sizes, the largest being about 6 mm. long. Madreporic canal single and small, lying close beside the dorsal mesentery. Genital gland usually with three main branches, situated anteriorly and dorsally, beside the mesentery and opening just above the mouth, well within the ring of tentacles. Otocysts ten, arranged in pairs beside the nerves, as usual. Ciliated funnels, very numerous on the mesentery, short and rather wide, apparently not on long pedicels, as in *S. digitata*. All specimens examined, collected from the end of April until the middle of July, contained more or fewer young in various stages of development. Average number from fifty to seventy-five; maximum 176. Nearly always the young were of two ages, several days apart; very rarely three broods were found.

Calcareous deposits: Miliary granules present in great quantities, often crowded together to form spots in the skin visible to the naked eye; these granules are very minute irregular rosettes, about 10 μ in diameter. Anchors, from 200-250 μ long, straight or slightly arched inward, with smooth arms; a few small blunt teeth on the vertex; arms not in the same plane as shaft but bent outward; posterior end broadened out to form a short notched or branched bow, with numerous fine pointed teeth. Plates from 130-140 μ long and about 110 μ broad; edges smooth; six anterior holes large, with about fourteen coarse blunt teeth; seventh large hole, with about four blunt teeth on its anterior margin, somewhat pointed behind; medium sized hole on each side of this and three small ones back of it, all with smooth edges. External side of the plate with a bow, which starting from the outer edge of the medium sized smooth holes, bends outwards and forwards, bearing a few teeth on its anterior border. All these calcareous particles are very much like those figured by Théel for *Synapta picta* (Challenger Report, Vol. XIV, Part XXXIX, Plate I, Fig. 9). But there are, in addition, small straight or curved rods about 200 μ long, which may be perfectly smooth, somewhat knobbed or enlarged and rough at the ends; more rarely slightly forked or branched. These rods occur only in the tentacles, chiefly at the tip, and they seem to be more abundant in young than in old Synapta. They lie parallel to the long axis of the tentacle, or if in a digit, parallel to its long axis.

Development: Eggs unusually large, about 210 μ in diameter, light yellow in color. They are set free in the body cavity of the adult, but whether self-fertilization takes place or not, I have been unable to determine. Artificial fertilization never succeeded, no matter whether the ova and spermatozoa came from the same or different animals. Ripe sperm and apparently ripe ova occur at the same time in the same individual. Segmentation is total and equal. No polar bodies were found, although looked for carefully. Segmenting eggs are surrounded by a delicate vitelline membrane, probably formed as a result of fertilization, as it is wanting in unfertilized eggs. At the 16-cell stage, the embryo appears as a ring or band, two cells wide and eight cells in circumference, surrounding a cavity which is cylindrical instead of spherical and open at both ends. The 32-cell embryo is arranged in four series of eight cells each; the upper- and lowermost of these series have a less diameter than the two middle series, and accordingly the embryo begins to assume the spherical form, although the sphere is still open at the poles. Subsequent divisions close these openings and form the complete blastula. Invagination takes place and the gastrula develops as shown by Selenka for *S. digitata*. The gastrula is well covered with cilia and soon escapes from the egg-membrane. It is very active and swims about freely in the body-cavity of the mother. Development takes place directly without any metamorphosis. The gastrulas soon become less active and after a short time lose their covering of cilia. The subsequent changes until the assumption of the pentacula form involve so many debatable points that they cannot be entered into here, but a complete account of them will be published hereafter. The young remain in the body-cavity of the adult for an indefinite period; many are born when not more than five or six mm. long and with the tentacles still few and simple; but it is no uncommon occurrence to find young 20 mm. long, with branching tentacles and pigmented skin, still inside the adult. The young escape from the body-cavity into the cloaca and thence through the anus to the exterior.

Habits: The animals live more or less socially in clusters of seaweed on the roots of mangroves. They creep about by means of the long slender tentacles, assisted by the numerous anchors in the skin. Their food consists of minute algae, crustaceans and worms. They are very delicate, sensitive to changed conditions, and do not thrive in aquaria.

Distribution: I have found this *Synapta* only at Port Royal in Kingston Harbor. I have looked for it elsewhere in the harbor and in suitable places in other ports of Jamaica but without success. It appears to be very local even at Port Royal, and the area, where it may be found at all commonly, is very limited.

From all these facts it is clear that, although differing in its manner of life, its being viviparous and its lack of a metamorphosis, from other members of the genus, this species is a true *Synapta*. As Ludwig has already suggested (Arch. de Biol., Vol. II, 1881) there ought to be some better ground for generic distinction than the stage at which the young are born, and lacking this, *Synaptula* has no standing as a genus and becomes a synonym of *Synapta*. The species *vivipara* belongs to the same section of the genus as *S. inhaerens*, as shown by the anchors and plates and the number of tentacles. It is very interesting to note that in every particular given in his description, the species from Bermuda described by Théel (Challenger Report, Vol. XIV, Part XXXIX, page 10) as *S. picta* agrees with *S. vivipara*. As there was only one small specimen of *S. picta* in the collection, and nothing is known of its habits, the identity of the two species is uncertain, but at any rate their similarity is very remarkable, and further information regarding the Bermuda species would be of great interest.

A more general account of *S. vivipara*, with figures of the anchors and plates and the early stages of the embryo, may be found in the "Journal of the Jamaica Institute," for July, 1896.

Marine Laboratory of the Johns Hopkins University,
Port Henderson, Jamaica, June 30, 1896.

The Follicle Cells in Salpa.

By MAYNARD M. METCALF.

Through the courtesy of Professor Brooks of the Johns Hopkins University, I have been enabled to examine a number of finely preserved embryos of several species of Salpa, and I desire, after briefly referring to certain points in recent papers upon Salpa embryology, to describe such of the results of my study as bear upon the nature and role of the follicle cells.

Since the publication, fifteen years ago, of Salensky's careful studies [see references at end of paper], interest in the development of this genus has centered more around the follicle cells and their role than around any other point. Salensky showed that the young embryo was composed, in part, of a few true blastomeres derived from the fertilized egg, but more largely of a great mass of cells derived by proliferation from the follicle. He claimed that the true blastomeres early disappear, serving probably to nourish the inwandering follicle cells, from which the adult organism is derived. That is, according to Salensky, the fertilized ovum serves merely as food for its unfertilized sisters (the follicle cells), which are the really important elements.

He says, page 362: "Aus den vorgeführten Stadien lässt sich der Schluss ziehen, dass die Blastomeren fortwährend an Zahl abnehmen, bis sie endlich ganz verschwinden. Diese Erscheinung kann auf zweierlei Weise erklärt werden. Entweder gehen die Blastomeren unter allmählicher Verkleinerung zu Grunde—sie könnten als Nährmaterial für die Bildungszellen dienen—oder sie verändern unter fortwährender Theilung Form und Bau und vermischen sich so mit den Gonoblasten, dass sie endlich von den letzteren nicht zu unterscheiden sind. Diese Frage durch directe Beobachtung entscheiden, ist sehr schwer, und bei dem Material, das mir zu Gebote stand, war das unmöglich. Ich will deshalb hier nur Thatsachen vorführen, welche für und gegen diese beiden Voraussetzungen sprechen können. Erstens will ich bemerken, dass Form und Bau der Blastomeren so characteristisch ist, dass sie mit den Gonoblasten schwer zu verwechseln sind. Selbst bei den kleinen Blastomeren, wie wir in Fig. 2 sehen, kann man nach dem Kern jedes Blastomer, wenn es auch nur von Gonoblastengrösze ist, ganz gut von den Gonoblasten unterscheiden. Der Blastomerkern ist rund, opak, färbt sich mit Carmin besser als der eines Gonoblasten, welch letzterer einer ovale Form besitzt und ein kleines punktförmiges Kernkörperchen beherbergt. Zweitens will ich darauf aufmerksam machen, dass man in dem zuletzt betrachteten Stadium Blastomerenkerne antrifft, welche noch ihre Grösze behalten, aber deren Begrenzung nicht so scharf ist wie es in den Blastomeren der früheren Stadien der Fall ist. Sie verlieren also ihre scharfen Contouren, was schon darauf hinweist, dass diese Kerne in der That solchen Veränderungen unterliegen, welche ihr Absterben sehr wahrscheinlich machen. Endlich gegen die Verwandlung der Blastomeren in Gonoblasten-ähnliche Zellen spricht auch der Umstand, dass man nie Übergangsformen antrifft, was doch der Fall sein müsste, wenn eine solche Verwandlung in der That existirte. Auf Grund alles dieser Thatsachen bin ich zur Überzeugung gelangt, den die Blastomeren in der That allmählich schwinden, um die Hauptrolle bei der Entwicklung den Gonoblasten zu überlassen."

Todaro, in 1881, had described a peculiar fragmentation of the blastomeres by which each broke up into numerous small nucleated cells. Salensky, referring to this point, describes the phenomena as follows, page 99: "Das Protoplasma dieselben [of the blastomeres], welches in allen frühheren Stadien feinkörnig, beinähe homogen war zerfällt jetzt in kleine mannigfaltig gestaltete Parcellen, die theils um den Kern, theils in der Peripherie der Zellen gelagert sind. Als ich zum ersten Mal diesen eigenthiemlichen Zerfall des Protoplasma beobachtete, glaubte ich es mit dem Product der Einwirkung der Conservations—oder Färbeflüssigkeit zu thun zu haben. Derselbe kommt aber so beständig in gewissen Stadien der Entwicklung, namentlich nach dem ersten Forschungsstadium, vor und erscheint von der Art des Conservirung so unabhängig, dass ich bald zur Überzeugung gelangte, dass diese Veränderungen des Protoplasma normale Entwicklungsvorgänge darstellen."

He speaks in another place, page 125, of "kleinen polyedrischen Protoplasmastückchen, in welchen ich trotz aller Mühe selbst an sehr schön gefärbten Präparaten, keinen Kern zu unterscheiden im Stande war. Ich muss deshalb die Zellennatur dieser Protoplasmastückchen vollständig in Abrede stellen."

From these quotations it is seen that he denies the cellular nature of the bodies within the blastomeres, but offers no explanation of their true nature.

More recent papers by Brooks, Heider, and Korotneff have dealt with the relations between blastomeres and follicle.

Brooks, in 1893, confirmed Salensky's description of the complex character of the young embryo, pointing out with the greatest clearness that the follicle cells multiply very rapidly, by *amitotic* division, the resulting cells pushing in among the blastomeres, which for a long time remain few in number.

He further showed that, as Salensky described, these migrated follicle cells give rise to outlines or models of the organs. He, however, took issue with Salensky as to the ultimate fate of blastomeres and follicle, claiming and clearly showing that in the later stages the follicle cells composing the outlines of the organs are replaced by true blastomeres which give rise to the adult. He says, page 27: "Stated in a word, the most remarkable peculiarity of the salpa embryo is this. It is blocked out in follicle cells which form layers and undergo foldings and other changes which result in an outline or model of all the general features in the organization of the embryo. While this process is going on the development of the blastomeres is retarded, so that they are carried into their final positions in the embryo while still in a very rudimentary condition. Finally when they have reached the places they are to occupy, they undergo rapid multiplication and growth, and build up the tissues of the body directly, while the scaffolding of follicle cells is torn down and used up as food for the true embryonic cells."

Brooks' Figs. 1 and 2, Plate XLII, also Fig. 12, Plate IX, as well as his descriptions, demonstrate that the peculiar granular bodies seen within the blastomeres at certain stages of development are not an indication of the fragmentation or degeneration of the blastomeres, but are nuclei of follicle cells that have been ingested and are undergoing digestion. This statement I have fully confirmed, as described a few pages beyond. The amitotic division of the migrating follicle cells confirms the belief that they are on the road to degeneration, and in the center of the embryo there are found masses of such disintegrating cells.

Heider's account of the embryology of Salpa fusiformis, published in 1895, differs in certain points from preceding accounts.

He interprets the granular bodies in the protoplasm of the blastomeres as ingested follicle *cells* and figures them as *containing nuclei* (Plate I, Figs. 4, 10^a, 10^b), and largely from this observation argues, as Brooks had shown, that the follicle cells serve as food for the blastomeres.

Heider places emphasis upon the unequal cleavage of the salpa ovum, claiming, contrary to Salensky and Brooks, that, except in the early stages, the micromeres cannot be distinguished from the follicle cells, and that organ rudiments, which are apparently formed from follicle cells, are really composed of small blastomeres.

The insufficient reference in Heider's paper to Brooks' monograph may perhaps be explained by the fact that Heider's paper was practically complete before Brooks' work was published.

Korotneff's several papers are the most recent dealing with this subject. This author denies Heider's contention that the smaller blastomeres are difficult to distinguish from follicle cells, figuring and describing them as distinctly different, even in advanced embryos. On this point, then, Salensky, Brooks, and Korotneff agree in opposition to Heider.

As to the nature of the granular bodies in the protoplasm of the blastomeres, Korotneff says [Korotneff, III, p. 342]: "In meiner Schrift über die Embryologie von S. democratica habe ich mich gegen den Vermuthung von Heider, wonach diese Ablagerungen keine Dotterpartikelchen, sondern von den Blastomeren verzehrte Follikelzellen seien, ausgesprochen. Jetzt kann ich meine Meinung bekräftigen und ganz positiv behaupten, dass in den als Dotterplättchen bezeichneten Gebilden niemals eine Spur von Kernen zu sehen ist"—which is certainly true, at least for S. hexagona and S. pinnata, since these granular bodies are not ingested cells, but ingested follicle *nuclei*, as Brooks had shown, and as is evident in the material I have worked upon. The needle-like bodies figured by Korotneff in the protoplasm of the blastomeres of S. cordiformis-zonaria, I have not seen described before. They appear from his figures to be peculiarly arranged chromatin particles within the ingested follicle nuclei. (Compare Korotneff, III, Plate XIII, Fig. 14.)

Korotneff fully confirms Brooks' description (without, however, mentioning Brooks) of the disintegration of the follicle cells in the central region of the embryo, speaking of a retrogressive metamorphosis of the Kalymmocytes, "welche ganz blass werden, sich schlecht färben und zuletzt nur noch in spuren zu erkennen sind. Kurz und gut, die Kalymmocyten gehen ganz zu Grunde, und ihre Bruchstücke dienen gewiss den Histogenen [blastomeres] als Nährmaterial" [by osmosis]. (Korotneff, III, p. 335.)

Korotneff denies Brooks' statement that the organs are blocked out in follicle cells which later are replaced by blastomeres, saying that the organ rudiments are from the first composed of blastomeres. If he is not contending over definitions, his statements on this point are difficult to understand, for his figures show with the greatest clearness just the condition of affairs Brooks has described. [Compare Korotneff, IV, Taf. XVIII, Fig. 5 (rudiment of cloaca composed of follicle cells alone), Figs. 6, 7, and 8 (rudimentary walls of amniotic cavity composed wholly of follicle cells), Fig. 9 (pharynx rudiments composed chiefly of follicle cells), etc.]

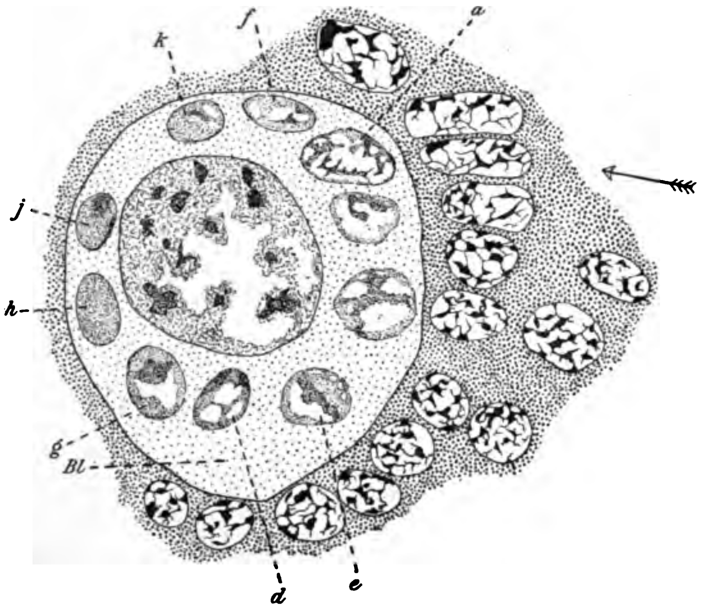

FIG. 1.

Portion of a section of a young embryo of *Salpa hexagona* showing one blastomere and fifteen migrated follicle cells.

Bl = blastomere. *N* = nucleus of blastomere. *a, b, c, d, e, f, g, h, j, k,* = nuclei of follicle cells ingested by the blastomere.

I wish now to call particular attention to my own observations upon the nature of the disputed bodies within the protoplasm of the blastomeres of Salpa.

After having examined several hundred blastomeres, all showing the intra-protoplasmic bodies under discussion, I have selected a single blastomere to figure and describe, not because there are not many others showing a similar condition, but because this seems sufficient to establish the poir

The blastomere figured is one of five appearing in a section of an embryo of S. hexagona at that stage of development when the follicular epithelium of one-half the surface of the embryo is most rapidly proliferating—about the stage shown in Brooks' Fig. 2, Plate XI. The arrow indicates the direction of movement of the follicle cells as they wander into the center of the embryo, where, as described by Brooks, many of them degenerate. The figure is carefully drawn with a Leitz $\frac{1}{12}$ immersion objective and a number 8 compensating ocular.

The large blastomere, *Bl*, has a very large nucleus, *N*, and evenly granular protoplasm which does not stain deeply with haematoxylin, borax-carmine, or saffranin. Outside the blastomere is a mass of more coarsely granular and deeply staining protoplasm in which no cell walls can be discovered, but in which appear many nuclei, all exactly resembling the nuclei of the follicular epithelium. These have a definite chromatic reticulum with rather small nodal swellings and no nucleolus.

Within the protoplasm of the blastomere as shown in this one section are seven bodies similar in size to the follicle nuclei just described, but quite different in appearance. I believe them to be ingested follicle nuclei. They do not stain so deeply as the nuclei outside, though they are much darker than the protoplasm of the blastomeres in which they lie. We do not find in them the clear cut chromatin reticulum with sharp contours such as we see in the follicle nuclei, but in certain of them we do find what appears to be such a chromatic reticulum degenerating because undergoing digestion. Observe especially the nucleus *a*. The reticulum is evident, and I think no one can doubt that the body is really a nucleus. Compared with the follicular nuclei the reticulum is seen to stain less deeply and the fibrils and nodal masses do not have sharp contours. The whole appearance indicates the beginning of disintegration. I believe this nucleus to have been ingested but a short time previous to the killing of the embryo. At *b* and *c* are nuclei which have gone further in the process of degeneration, the chromatin threads being more diffuse. At *d*, *e*, *f* and *g* we see a further stage in the same process and at *h*, *j* and *k* we observe within the ingested nuclei an almost evenly granular mass of disintegrating chromosomes. In other blastomeres and in another section of this same blastomere one can observe the last step in the degeneration, a mere mass of debris no longer delimited by a nuclear membrane from the surrounding protoplasm of the blastomere.

Notice that the less degenerated of these ingested nuclei lie on the side nearer the periphery of the embryo. The inwandering follicle cells, as they push toward the center of the embryo, penetrate the blastomeres that lie in their path. Apparently the most recently ingested nuclei, entering from the peripheral side, crowd the partly digested ones toward the inner side of the blastomere, giving the appearance figured. Not every section of a blastomere shows such diagrammatic arrangement, but this condition is noticeably frequent. The section figured was chosen because of the diagrammatic way in which it shows this point, and because of the clearly nuclear nature of the body *a*.

As before mentioned, Brooks has given exactly this interpretation of the bodies within the blastomeres, and this confirmatory note would be uncalled for except for Heider's and Korotneff's more recent papers giving a different interpretation. It is possible that in S. runcinata-fusiformis (the species Heider studied) not only the follicle nuclei but also their cytoplasm may be ingested by the blastomeres, but I am more inclined to believe Heider was mistaken when he figured these bodies as nucleated cells. His figures are not drawn with careful attention to detail, so it is hard to judge from them. In S. pinnata and S. hexagona no cell walls can be made out in the mass of migrated follicle cells. It is therefore by no means probable that the cytoplasm of the follicle cells could be seen if it were ingested with the nuclei. This is especially true in view of the digestive action upon these bodies within the blastomeres.

Korotneff's and Salensky's statements that these bodies contain no trace of a nucleus within them is, of course, true if they be themselves nuclei.

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THE BIOLOGICAL LABORATORY OF THE
WOMAN'S COLLEGE OF BALTIMORE,
May 13th, 1897.

Budding in Ecteinascidia. By GEORGE LEFEVRE, Adam T. Bruce Fellow in the Johns Hopkins University.

(This paper appeared in the Anatomischer Anzeiger, xiii Bd. No. 18).

During the past four or five years the study of budding in Compound Ascidians has received much attention, but in spite of both recent and earlier work on the subject a great deal is still obscure and statements of various authors are not always in accord. The origin of the hypophysis and ganglion, for instance, has given rise to much discussion, and here lack of agreement in observation has been most conspicuous. It has been maintained on the one hand that these organs arise independently of each other, and on the other that they are derived from a common source, while the whole range of possibilities has been exhausted in ascribing to them either an ectodermal, an endodermal or a mesodermal origin.

Although it is certainly true that the derivation of these and other structures is by no means the same in all Ascidian buds, there yet remain many conflicting observations, and until more light has been thrown on the subject, much must be left in doubt. Further investigation is, therefore, of value, and it is especially desirable to study the process in species in which it has not already been described, as those whose bud-development has been examined are comparatively few in number.

However much opinion may differ in regard to individual questions, all recent work goes to show that embryonic and bud-development do not proceed along parallel lines, and that the two cannot be brought into harmony with each other. The Ascidian bud must be looked upon as a "new-formation," acting under its own laws. The facts of the bud-development cannot be harmonised with the germ-layer theory.

This conclusion is further emphasised by results which I have recently obtained from a study of the process in one of the *Clavelinidae*, namely, *Ecteinascidia*, a genus founded by Herdman in 1880 for some specimens from the Challenger Expedition.

The material which I have had at my disposal was collected in Jamaica and belongs to Herdman's species, *E. turbinata*. (For a description of the species see Challenger Report, Zool., Vol. VI, pp. 243–5.) The family of the *Clavelinidae* contains the well known genera, *Clavelina* and *Perophora*. The bud-development of the former is familiar from the classic work of Van Beneden and Julin,[1] and that of the latter has recently been described by Ritter[2] for a new species, *P. annectens*, from the California coast, and briefly by myself[3] for the eastern species, *P. viridis*. These are the only genera of the family whose bud-development has hitherto been studied.

Although in external appearance the zoöids of *E. turbinata* resemble somewhat those of *Clavelina*, as they are quite elongated and the two siphons are placed anteriorly, the species shows a closer similarity to *Perophora*, both in the structure of the adults and the mode of development of the buds. It differs from *Clavelina* and agrees with *Perophora* in the total absence of an epicardium such as Van Beneden and Julin describe, and also in the absence of an abdomen; in other words the digestive tract does not lie behind the pharynx but almost entirely on the left side of the latter. But it is distinguished from both of these genera by the presence of perfect internal non-papillated longitudinal bars in the walls of the branchial sac.

The bud-development is strikingly like that of *Perophora*, although no rotation or displacing of the inner vesicle occurs, as has been described in the latter.

In members of this family it is well known that the buds arise on a proliferous stolon which grows out from the base of the larva during the metamorphosis. This is also true of *Ecteinascidia*, and as in all other Ascidians, the bud-rudiment consists of two simple vesicles, one within the other. The outer or ectodermal one is derived directly from the ectoderm of the stolon and the inner or endodermal vesicle from the stolonic cloison or septum. The latter structure, however, cannot in truth be called a *septum* at all, as it is not a flat double-walled partition, as in *Perophora*, extending across the lumen of the stolon and dividing it longitudinally into two compartments or sinuses; but it is a tube lying inside the ectodermal wall of the stolon, and is bathed on all sides by the blood.

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[1] Archives de Biologie, T. VI, 1887.

[2] Journal of Morphology, Vol. XII, No. I, 1896.

[3] Johns Hopkins University Circulars, No. 119, June, 1895.

In *Ecteinascidia* the axial relations of the bud and stolon are quite different from those which occur in *Perophora*. In the latter the bud is connected with the stolon on its ventral side, which lies parallel with the long axis of the stolon, while in *Ecteinascidia* the connection is at the extreme posterior end of the bud which stands up at right angles to the stolon, as in *Clavelina*.

At the point where a bud is to be formed, the ectoderm of the stolon thickens and becomes raised up into a knob-like protuberance into which the inner stolonic tube sends a much thickened evagination to form the primitive inner vesicle. The bud-rudiment elongates in a direction perpendicular to the stolon, and its free end becomes the anterior end of the bud, the stolonic connection being posterior as stated above. The right and left sides are parallel with the stolon and in all the cases I have observed the ventral surface of the bud faces toward the growing tip of the stolon.

A section at a very early stage shows that the right side of the inner vesicle towards the posterior end has become much thickened, and many cells in this region are wandering out to give rise to an extensive mass lying on the outside and reaching from the dorsal to the ventral border. The outer membrane of the wall of the vesicle is interrupted at many points and here direct continuity exists between the wall and the clump of cells. I have frequently obtained cases where there can be no doubt that cells are in the act of migrating from the vesicle into this mass, which is the rudiment of the *pericardium*. Fig. 2 represents a cross section of this region of the vesicle after the rudiment, *pc. r.*, has attained a considerable size. At the points indicated by the lines marked *a* and *b* two nuclei are shown at the different stages of the process of passing out of the wall, so that there can be no doubt as to what is taking place. Sections like this could be multiplied indefinitely and many figured in which the boundary line of the wall is absent over a considerable area. The pericardium is therefore derived directly from the inner vesicle, as Ritter (*l. c.*) has described for *Perophora annectens*. But around the periphery of the rudiment the cells lie loosely together and there is every indication that free amoeboid cells of the blood are being added to the mass from the outside and aiding in its formation to a slight extent. This is shown more or less distinctly in the section drawn in Fig. 2. I might also state here that I have seen, especially at very early stages, clear cases of cells migrating from the inner vesicle into the body-space where they are set free. (See Fig. 7, *a*, and also lower right hand corner of Fig. 6.) This must, therefore, be one source at all events from which cells of the blood are derived, as Ritter holds for *[illegible]ophora annectens*, and it is highly probable that they supplement the cells which are given off directly from the wall of the vesicle to the rudiments of the pericardium and other organs.

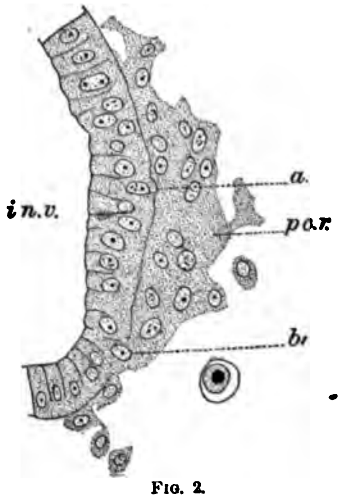

FIG. 2.

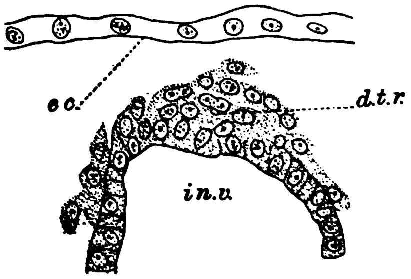

FIG. 3.

The pericardial rudiment soon acquires a cavity, loses its connection with the vesicle and forms a closed sac which gives rise to the pericardium and heart in the usual manner.

One of the first structures to make its appearance is the *endostyle*, which is indicated by a distinct groove running through almost the entire length of the inner vesicle, at a very early stage, namely, long before the folds which will cut off the peribranchial sacs, are seen.

The latter are formed symmetrically by two folds which appear in the ventral wall of the vesicle on each side of the endostylar groove, and as they deepen, grow in to meet each other in the manner described for *Botryllus*, *Perophora* and other Ascidians. The median portion or atrium of the peribranchial cavity is therefore cut off from the primitive vesicle at the same time with the lateral sacs, and connects the latter dorsally.

The deepening and coming together of the peribranchial folds proceed from before backward, and as a result of this the atrium is found entirely separated from the primitive vesicle in the anterior region at a time when the folds stand widely apart more posteriorly. Eventually, however, the process is completed, and instead of the original simple vesicle we find the median or branchial sac surrounded by the saddle-shaped peribranchial cavity.

By the time the peribranchial folds have begun to appear, the connection of the primitive vesicle with the inner tube of the stolon has become severed as a rule, although this is a very variable occurrence and may take place at an earlier or later period.

The *dorsal tube* or *hypophysis* arises from a little string of cells which wander out from the extreme anterior end of the inner vesicle at quite an early stage. The evidence for this mode of origin is just as clear as in the case of the pericardium; the boundary line is broken at many points on the wall; active cell-division is seen to be going on in the latter, and cells are frequently found actually migrating into the rudiment. It is very probable that here, too, cells of the blood take part in the formation, as they are seen adhering to the outside of the mass and apparently becoming incorporated with it. In fact, no sharp distinction exists at early stages between the peripheral cells of the rudiment and cells lying free in the body space, as they pass gradually into each other and are identical in appearance. A very young stage is figured in Fig. 3, *d. t. r.*, which is taken from a frontal section but shows the rudiment of the dorsal tube cut transversely, as its position on the extreme tip of the long narrow inner vesicle is almost at right angles to the long axis of the bud. This figure shows the origin from the wall of the vesicle very distinctly, and also the fact that cells of the blood appear to be attaching themselves to the young rudiment.

The rudiment soon becomes compact and rounded off, and the lumen which appears in its centre is eventually put into communication anteriorly with the cavity of the branchial sac.

The *ganglion* is differentiated out of the dorsal wall of the hypophysis along the entire length of the latter and finally becomes completely separated from it. The beginning of the rudiment is shown in Fig. 4, *gl. r.*, where it is merely indicated by a slight thickening of the dorsal wall before there is any separation. In Fig. 5, *gl.*, the ganglion has practically attained the adult structure. Between these extremes all intermediate stages may be clearly observed. The ganglion is not constricted off from the hypophysis, as Hjort[1] has described for *Botryllus*, but after the thickening has proceeded to a certain extent, a new outer membrane appears between that portion which will form the ganglion and the rest of the wall, thus causing a complete separation.

Along the posterior half of the dorsal tube the ventral wall breaks down completely; nuclei multiply rapidly and wander out into the space between the tube and the roof of the branchial sac, where they are found scattered about in a mass of loosely reticular cytoplasm; it is out of this tissue that the *sub-neural gland* is formed, Fig. 5, *s. n. g.*

Before there is any indication of the peribranchial folds, the *digestive tract* grows out as a blind diverticulum from the posterior end of the inner vesicle on the dorsal side immediately in front of the connection with the stolon. It bends sharply to the left, and growing forward, ultimately unites at its free end with the posterior wall of the atrium, into which it opens by the anus.

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[1] Mitth. Zool. Station Neapel, X Bd., 1893.

The "*organe réfringent*" arises as a tubular diverticulum from the dilated region of the digestive tract, and becoming much branched, surrounds the long intestine with its terminal twigs.

At quite an early stage of the development a small clump of cells is found lying against the wall of the inner vesicle just in front of the commencing diverticulum of the digestive tract and extending slightly down on the left side of the vesicle. These cells constitute the rudiment of the *sexual organs*, and are derived in the same way as the pericardium and dorsal tube, namely, by proliferation of cells in the wall of the inner vesicle. Fig. 6, *s. r.*, illustrates the origin of the rudiment which at this young stage is an irregular mass of cytoplasm containing a few scattered nuclei; the interruption in the outer membrane of the wall is clearly shown. There is the same evidence again as was pointed out above, that cells of the blood become attached to the rudiment and contribute to its formation. The rudiment lies at first in the angle made by the base of the digestive tract and the side of the vesicle, but after it has become detached from the latter, it is carried further down on the left side apparently by the growth of the gut, in the bend of which it seems to be loosely held for some time. As far as I have followed it the further development of the sexual organs takes place in the manner described by Van Beneden and Julin (*l.c.*) for *Perophora Listeri*. The rudiment soon becomes a spherical vesicle by the appearance of a cavity in its centre, and the genital cord grows out from it anteriorly as a long string of cells. This simple vesicle divides into two whose cavities at first communicate but finally become separated. One of these vesicles gives rise to the ovary, the other to the testis, and the genital cord, which splits into two ducts, forms the oviduct and vas deferens.

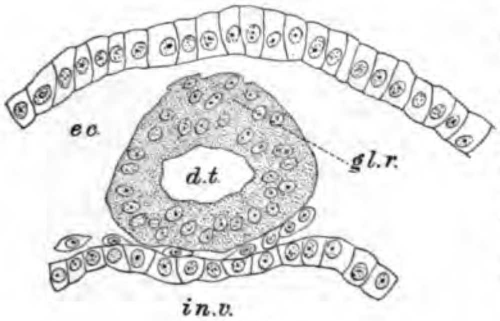

FIG. 4.

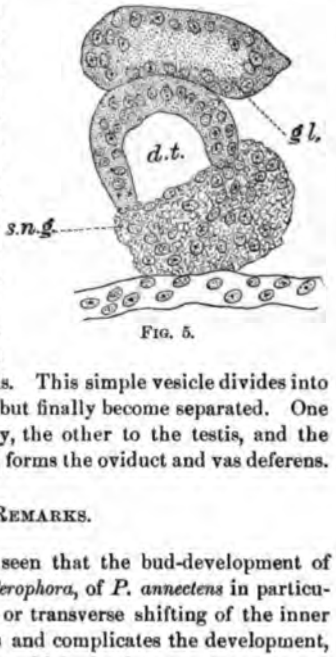

FIG. 5.

CONCLUDING REMARKS.

From the above brief account it is seen that the bud-development of *Ecteinascidia* is strikingly like that of *Perophora*, of *P. annectens* in particular, and although the peculiar rotation or transverse shifting of the inner vesicle which occurs in the latter genus and complicates the development, is absent in the former, the manner in which the important organs are formed, is very much the same. The absence of an epicardium with which the formation of the pericardium is closely connected, sharply contrasts these two genera with *Clavelina*, which presents practically a different method of development.

In *Ecteinascidia* and *Perophora annectens* the pericardium, dorsal tube and ganglion, and in the former species the sexual organs also, are all formed, for the greater part at any rate, from cells which wander out directly from the walls of the inner vesicle into the rudiments; and it is quite probable, as we have seen, that free cells of the blood are also involved to some extent in their formation. In *P. viridis*, however, I believe that these organs are derived *entirely* from the latter source. A detailed paper on the budding of this Ascidian will shortly appear, and in it I have presented the full evidence for this belief. It is certainly true that cells do not pass out directly from the vesicle into the rudiments of the above mentioned structures, but although I have observed no cases of cells being given off to the blood at other points on the wall, it is possible that in some buds, or at certain times at least, such an occurrence does take place. This supposition is made probable by the fact that cells of the blood are known to arise from the vesicle in *Perophora annectens* and *Ecteinascidia*. In these latter forms, therefore, the organs in question are derived in large measure *directly* from the primitive vesicle, while in *Perophora viridis* their origin from the vesicle would be traced only indirectly through cells of the blood, if the latter, as is probably the case, come from this source. At all events the two processes would not be essentially different in nature, the inner vesicle being the starting point in both cases.

The primitive vesicle is therefore the all-important part of the bud-rudiment, and upon it devolves the duty of providing material for the formation of all the internal structures, as the ectoderm plays no active role in the development except in so far as it is concerned in the production of the cellulose test. This conclusion apparently holds good for all Ascidians whose bud-development is known, with the possible exception of *Perophora viridis*, and has been sufficiently proven to be accepted as a general rule.

The inner vesicle alone, whether derived from an ectodermal or an endodermal larval structure, gives rise to all the corresponding organs which in embryonic development proceed from the two primary germ-layers, and in some cases also furnishes cells to the blood, e. g., in *Ecteinascidia* and *Perophora annectens*. It is therefore an undifferentiated structure, and like the blastula, contains the potentiality of the whole organism.

All parts of the simple epithelial wall, however, are not alike, but one definite area holds in its cells the material out of which one organ is built up, while another clearly defined region produces a second structure, and so forth.

But this internal differentiation or mapping out of the vesicle, is present in different degrees in different Ascidians, and in fact we are able to pick out a series of forms which present a gradation from the least to the most differentiated condition. At the lowest end stands *Perophora viridis* in the buds of which free cells of the blood attach themselves to the outer surface of the inner vesicle and form definite organs. It has not been proved by direct observation that these cells arise from the vesicle itself, but whatever be their source, whether it is the mesoderm of the embryo or the inner vesicle of the bud-rudiment or both, cells of the blood adhere to the wall at certain constant points and there become pericardium or nervous system for example. I have argued in my paper on *Perophora viridis* that it is much more probable to suppose that the cells which build up these structures are all undifferentiated and alike and that it is the particular point of attachment which determines what kind of organ will proceed from them. It is almost impossible to imagine that isolated cells, floating freely in the blood, could reach their proper destination if they possessed a predetermined nature, and some were already cells of the nervous system, others of the pericardium, etc. But it is much more probable that they have all an indifferent character, and their presence at any given place is purely accidental; once there, however, qualities latent in them are called forth under the specific formative influence of the place of attachment. The wall of the vesicle is, therefore, only differentiated in so far as it possesses the power of determining whether cells of the blood which lodge on these particular areas shall give rise to pericardium, nervous system or sexual organs, as the case may be.

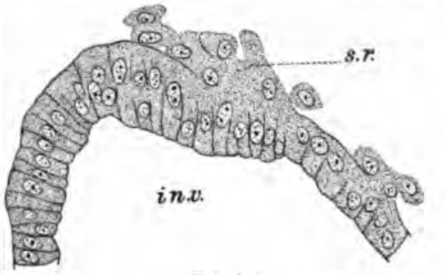

FIG. 6.

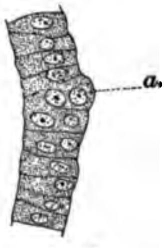

FIG. 7.

At a step higher in the degree of differentiation we find *Ecteinascidia* and *Perophora annectens*. In these forms the inner vesicle is known to be one source at all events of cells of the blood, which, however, play but a small part in the development. But at those portions of the vesicle on which

The environment in which Tripedalia was found is still more unlike that in which Cubomedusae have been taken heretofore. It was obtained in two localities, both of which were cut off from the main body of the Harbor, and so from the ocean, by peninsulas and islands covered with a growth of mangrove. The water was shallow and discolored with organic matter, and the bottom for the most part a black mud. The regions were virtually mangrove swamps. It was under the shelter of the overhanging mangrove boughs, among their half-submerged roots, that the Tripedalia was found thriving in large numbers. Conditions more strikingly unlike those of the pure deep sea could hardly be imagined.

T. cystophora is as quick and vigorous a swimmer as the species of Charybdea. In one case as many as 110 pulsations were counted in a minute. Its brownish-yellow color enables it to escape observation not infrequently in the discolored water.

C. Anatomy.

An abundance of material of both species was preserved in several ways and has furnished subject-matter during the past year for investigation of the adult anatomy of the Cubomedusae. The results have been embodied in a paper whose publication I hope will not be greatly deferred. Meanwhile the mention of one or two points may not be out of place.

The parts to which especial attention was given were the vascular lamellae, or cathammal plates, and the nervous system. The vascular lamellae, being definite areas where the two walls of the gastro-vascular system have come together and fused, are interesting because they show how the present structure of the gastro-vascular system of the Cubomedusae has come about from a simpler, undivided condition. It was hoped that their study might throw definite light on the affinities of the group. The results, however, were unsatisfactory, for while one part of the system of lamellae pointed strongly toward a relationship with such Hydromedusae as, for example, Liriope (Trachomedusae), another part, around the margin of the bell, gave evidence equally as good to the effect that the velarium was formed by the fusion of marginal lobes and that the view which considers it not homologous with the Hydromedusan velum is therefore correct. The question as to the affinities of the Cubomedusae must wait until the development is known.

The nervous system has been described by Claus,[1] and more recently in greater detail by Schewiakoff.[2] With the latter's conclusions as to the structure of retina and vitreous body of the complex eyes on the sensory clubs I am unable to agree. Schewiakoff's conception of the structure is in brief as follows:

a. The retina is made up of two types of cells, pigment and visual, which are figured as alternating regularly. The pigment cells are cone-shaped; the visual are spindle-shaped, with their nuclei lying in the swollen central portion of the spindle, at a lower level than the nuclei of the supporting pigment cells.

b. From the visual cells extend rod-like processes into the vitreous body (which lies between the retina and lens) lying in canals in the vitreous body.

c. In the vitreous body separate cone-shaped streaks of pigment overlie the pigment cells, which do not, however, form part of those cells.

d. Apart from these pigment streaks and the rod-like processes of the visual cells, the vitreous body is structureless, probably a secretion of the pigment cells.

The conclusions reached upon the same points by the study of the two Jamaica species are:

a. There is not good evidence of two distinct types of cells in the retina—cone-shaped pigment cells and spindle-shaped visual cells, with the nuclei of the latter at a lower level than those of the former.

b. The rod-like processes in the vitreous body exist, though not referable to a special type of cell in the retina.

c. The cone-shaped streaks of pigment in the vitreous body belong to the underlying pigment cells, in fact are direct continuations of them; and at their distal ends they are prolonged into fibrous processes lying in canals of the vitreous body exactly like the visual rod-like processes of Schewiakoff.

d. The vitreous body, over and above these "visual fibres" and "pigment streaks," is not a homogeneous secretion, but is composed of prisms of gelatinous, refracting substance, each with a denser central fibre. The size of the cross sections of these prisms corresponds with that of the cross sections of the majority of retinal cells. It is probable, therefore, that they represent the outer ends of retinal cells.

From the above it will be seen that I find in the vitreous body two structures in addition to Schewiakoff's visual processes—namely, similar processes from the "pigment streaks," and the prisms that make up the mass of the body. I am inclined to believe that the retina contains at any rate two and perhaps three kinds of cells, but that these are distinguishable only by that part of them which lies in the vitreous body, and are not distinguishable in the retina as two alternating types, as figured by Schewiakoff.

In another point also I am unable to agree with Schewiakoff. In one region of the sensory club is found a mass of peculiar large, closely-packed, polygonal cells, which he affirms to be ganglion cells as against Claus, who considers them supporting cells. In my sections they show nothing whatever to suggest a resemblance to ganglion cells. No processes could be made out, and the body of the cell consisted of a beautiful cytoplasmic reticulum with thickenings at the nodes of the rather coarse meshes.

The sensory organs in the proboscis of Tripedalia are simple cysts of ciliated epithelium lying in the gelatine. The long cilia support and keep in constant motion an otolith of ragged outline, in which no trace of cellular structure was found. This is the only case, so far as I know, of the occurrence among the medusae of a free, unsuspended otolith in a ciliated sac.

D. Development.

Females of Tripedalia were found with stomach pouches, or pockets, filled with developing ova, so that I am able to offer a few facts preliminarily on the development of the Cubomedusae. The mature eggs pass from the ovaries into the stomach pouches and there develop up to the stage of free-swimming planulae. In with them are found floating masses of cells, showing here and there a nematocyst, whose structure points clearly to an origin from the ovary also. These masses circulate about among the developing ova and serve for protection and apparently also for nutrition, since the cells are found vacuolated in masses from individuals containing well advanced embryos. All the eggs or embryos in one individual are at the same stage of development. Gastrulation was not observed in the living material, but sections show a stage in which central cells lie clearly marked off from a surrounding ring of smaller surface cells, and the probability is that these endodermal cells were formed by delamination. When the spherical mass is beginning to elongate into the ellipsoidal form of the planula a large migration of cells from the surface into the centre takes place, not limited to one pole. The relation of the central cells earlier seen, and of these inwandering cells, to the definitive endoderm was not made out. The young are set free from the parent as ciliated planulae, having pigment spots on the posterior end. The planulae swim about actively on the surface for a day or two, their motion being both translation and rotation. Then they gradually lose the forward motion and rotate on their own axis in one spot. At this point they settle down, and the pigment spots which were on the posterior surface are found to migrate into the interior. In a day or two they bud out two tentacles, and shortly afterwards two more, though young hydras with three and five tentacles were by no means uncommon. In this condition they lived for three weeks in the aquaria without undergoing further development.

Search for scyphistomas in the region where the jelly-fish were found was fruitless. The youngest specimens taken in the tow were of practically the adult structure, so that the important intermediate stages remain unknown. The youngest jelly-fish were interesting, however, in that only the middle tentacle in each group was developed, and that the sensory clubs were situated almost on the margin, and were not yet enclosed in niches.

Reference Letters in Figures.

af—furrow, on inner surface of exumbrella underlying the adradial ridge on the outer surface; *afr'*—furrow on outer surface, setting off the area in which the sensory niche lies; *ct*—canal of the tentacle; *go*—gastric ostium; *ifr*—interradial furrow, on outer surface; *n*—nerve ring, on the subumbrella; *pe*—pedalium; *ph*—phacellus; *pr*—proboscis; *r*—reproductive organ; *sn*—sensory niche; *su*—suspensorium; *sub*—subumbrella; *vc*—velar canals.

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[1] Ueber Charybdea marsupialis. Arb. aus d. Zool. Inst. d. Univ. Wien. Bd. II., Heft 2, 1878.

[2] Beitrage zur Kentniss des Acalephenauges. Morph. Jahrb. Bd. XV., Heft 1, 1889.

Notes on the Embryology, Anatomy, and Habits of Yoldia limatula, Say. By GILMAN A. DREW.

In this short abstract, attention will briefly be called to some points of interest in the development, anatomy, and habits of *Yoldia limatula*, a member of Pelsner's Order, Protobranchia. A more detailed description will follow at a later time.

EMBRYOLOGY.

The eggs are about .15 mm. in diameter, of a chocolate-brown color, and very opaque. They are laid free in the water, and are not encumbered by any kind of envelope. The polar bodies are lost soon after they are formed. The first cleavage results in the formation of sub-equal blastomeres. Subsequent divisions give rise to an epibolic gastrula in which there may be as many as sixty outer ectoderm cells. Some of the ectoderm cells wander into the interior, the entoderm cells divide, and at one side of the resulting cell-mass, a narrow tube appears, which opens to the exterior through the blastopore. As it has not been determined whether this tube is ectodermal or endodermal in origin, whether it represents a stomodaem or a primitive gut, it will throughout this description be referred to as the ventral tube.

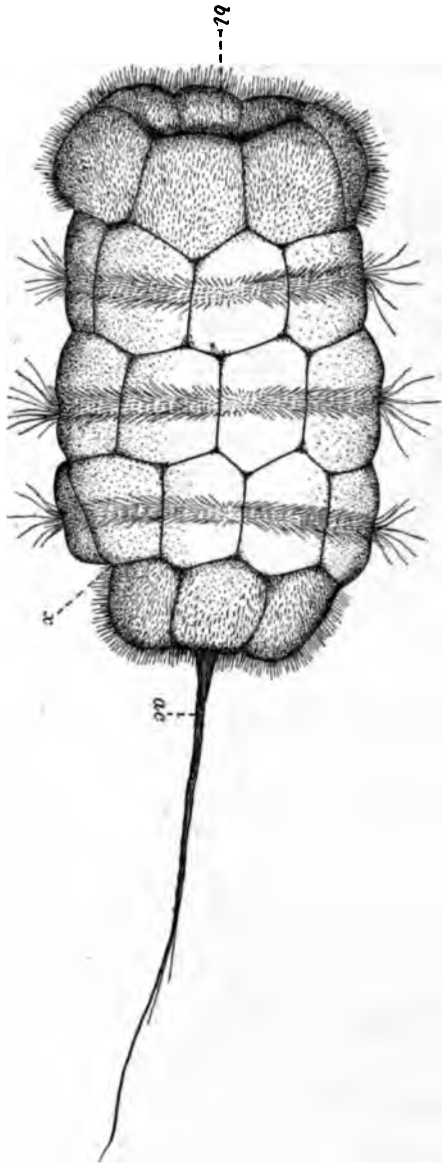

FIG. 10.

While these changes are taking place, about forty-two of the surface ectoderm cells enlarge, become vacuolated, and acquire cilia. The embryo also elongates, Fig. 10, becomes cylindrical, acquires an apical plate which bears a tuft of apical cilia, *ac*, and the outer cells, which will hereafter be referred to as test cells, arrange themselves in five rows. The blastopore, *bl*, occupies the end of the cylinder opposite the apical plate, and a depression, *x*, appears near the anterior end of what may now be referred to as the ventral side. The two end rows of test cells are entirely covered with fine cilia, and the three intermediate rows each bear a band of much longer cilia. The embryo now swims in more or less definite lines, rotating the while upon its longitudinal axis. During activity the apical cilia are bunched together into a sort of whip, and always precede the embryo.

Inside the test a new ectoderm is formed, probably from the ectoderm cells that wander in. At the age of about forty hours a few of these ectoderm cells elongate, and give rise to the shell-gland, which spreads over the dorsal portion of the embryo, but never forms a distinct invagination. At most it is only slightly concave when viewed from above, and soon becomes arched outward. These changes are accompanied by the formation of the mid-gut, a term that is not intended to include the ventral tube, which is of unknown origin. From the beginning, it is connected with the ventral tube, formed, as it were, as a continuation of the anterior extremity of the ventral tube.

From a time preceding the formation of the apical plate, a few cells of ectodermal origin have occupied an anterior position. These cells extend ventrally to the depression *x*, Fig. 10, and push in between the test cells. It was apparently from cells connected with this group that the apical plate was formed, and now, at about forty hours, other cells from this same group form two thick-walled pouches which open to the exterior between the test cells. These are the rudiments of the cerebral ganglia. Fig. 11 represents a transverse section of an embryo of fifty-eight hours, taken through the depression *x*, Fig. 10. The test, *t*, is shown to be composed of large, vacuolated cells, the walls between which are no longer very distinct. As this section cuts the anterior row of test cells, they are uniformally covered with cilia. The rudiments of the cerebral ganglia, *cg*, appear as two thick walled pouches. The wall of the anterior end of the mid-gut, *mg*, appears in section.

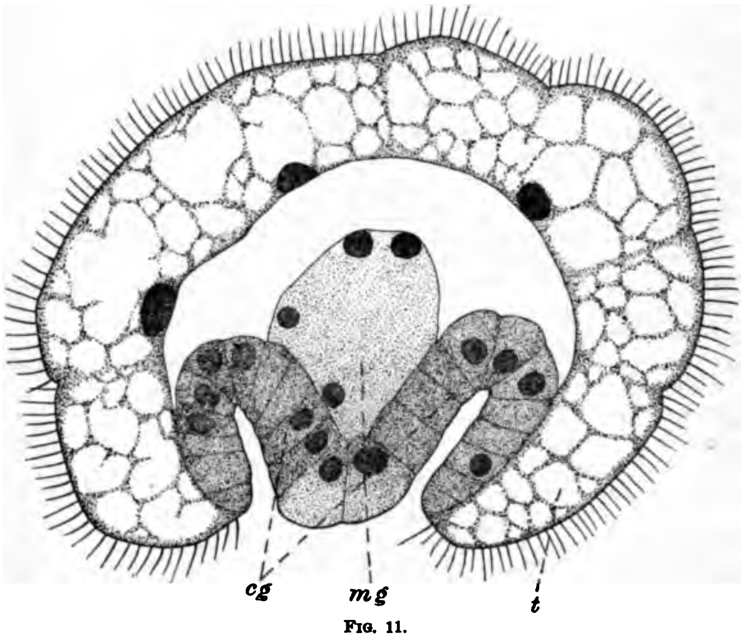

FIG. 11.

Fig. 12 represents a transverse section of another embryo at a corresponding stage, taken just in front of the second band of cilia. The shell gland, *sg*, has become arched upward, and is on the verge of protruding laterally to form the mantle. The mid-gut, *mg*, and the ventral tube, *vt*, are both shown in cross section.

This stage is of interest in showing the beginnings of the ectodermal thickenings that form the pedal ganglia, and the ectodermal invaginations that form the otocysts.

As the shell gland spreads out into the mantle, the embryo becomes slightly compressed laterally, the foot appears, and the visceral ganglia may be distinguished.

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Some Activities of Polar Bodies.

By E. A. Andrews.

The acceptance of the view that the polar bodies given off by the egg of animals are but imperfect eggs incapable of fertilization, and having no part to play in the development of the true egg, has naturally tended to lessen interest in their fate. That they often remain attached to the egg for a long time and that in certain insects, according to Henking, they may remain within the egg or go back again into it are facts that have seemed of no moment.

A recent paper[1] having shown that in certain Echinoderms the polar bodies as well as the egg are possessed of remarkable powers hitherto supposed to be limited to certain Protozoa, and that the polar bodies soon become, and may permanently remain, fused with the developing egg, makes it of great interest to inquire whether the polar bodies of other animals have such powers and such opportunities for possibly influencing the development of the egg.

It seems that in the star fish and the sea-urchin, the egg both before and after fertilization acts very like many filose Rhizopods: the protoplasm is seen to project itself out from the mass in the form of delicate, flowing currents of living material that form filose pseudopodia. These thread-like processes have the power to unite with or separate from one another, to lengthen or to shorten, to become thick or thin much as do the pseudopodia of Gromia. By means of such living material spun out from the cells, all parts of the young organism are held together as one continuous mass of living matter; the continuity being established as fast as cell division tends to interrupt it.

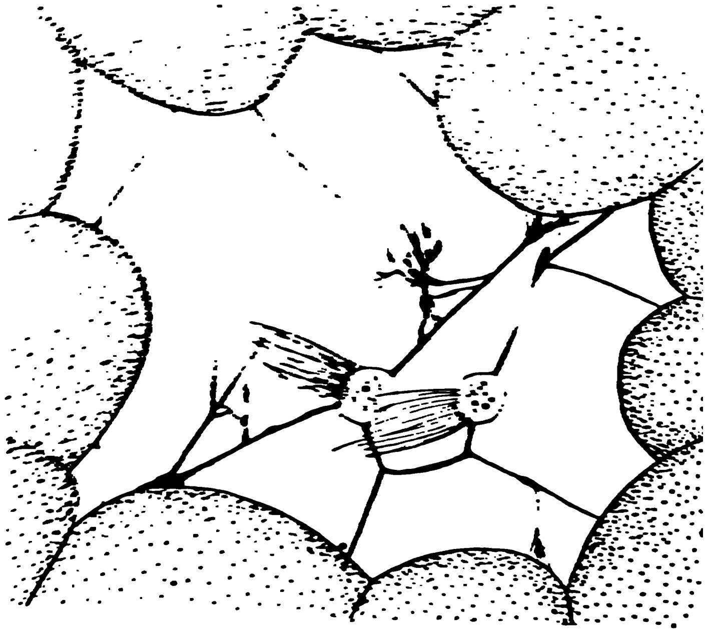
The polar bodies act like the cells of the cleaving egg and from the first become organically continuous with the egg cells by means of living threads spun out from the polar bodies and from the egg.

In figure 16, the polar bodies are represented lying over the relatively large opening that leads into the cleavage cavity of the many-celled blastula. This figure is from a camera lucida sketch made, in 1894, with Zeiss ocular 8, objective 2 mm and draw tube 170 mm. by G. F. Andrews, from the living [illegible] Under this magni[illegible] polar bodies are plainl[illegible] surrounding cells of the blastul[illegible] These are al[illegible] threads [illegible] from ea[illegible]

[illegible] threads spread [illegible] polar bodies.

[illegible] from the pol[illegible] spinnings may al[illegible]

[illegible] of these threads is [illegible] These processes extend from the [illegible] of the orifice or cleavag[illegible] tending to draw the proces[illegible]



[illegible]

Passing over many significant facts, we note that the polar bodies ma[illegible] pass through the cleavage-pore into the interior of the blastula, and b[illegible] connected with the complicated mass of threads joining the mesenchym[illegible] cells with the ectoderm and entoderm in the gastrula stage.

Thus in these animals the polar bodies long continue to act like Heliozoa and acquire a living continuity with the embryo which may extend t[illegible] the gastrula stage in such a way as to make them permanently part of th[illegible] organism.

In the large Nemertean, *Cerebratulus lacteus* Verrill, I find some spinnin[illegible] activities of the egg and its cells, and most marked activity of the pola[illegible] bodies. Soon after their formation the polar bodies send out delicat[illegible] Heliozoa-like rays, and later characteristic star-like groups of processe[illegible] that may develop into long proboscis-like outgrowths armed with lateral threads. From the first, the polar bodies are continuous with the egg and with one another by means of an exceedingly delicate film of material that sometimes shows fine threads and nodules within it, and seems living protoplasm rather than passive excretion or "slime."

In figure 17, the processes from the two polar bodies are indicated as see[illegible] under ocular 8, objective 2 mm. and draw tube 160 mm. and drawn, largely, with the camera lucida. The egg was in the four-celled stage and about t[illegible] divide again so that there were more than eight cells fifteen minutes late[illegible] The double membrane is indicated by two lines, some distance from the egg.

At this period the activities of the polar bodies have passed through their first phases and are gradually approaching their more permanent, later phases.

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[1] G. F. Andrews. Some Spinning Activities of Protoplasm. Journal of Morphology, XII, 189[illegible]

A more detailed account of these will be given elsewhere, but we will here note that the polar bodies continue to adhere to one another and to the egg for a long time, even if the membrane be removed and they be exposed to the sea-water. When the larva becomes ciliated, the polar bodies break loose and float about in the liquid between the larva and its membranes, but they still adhere to one another, and are sometimes seen attached to the egg membrane. Probably they are lost when the larva breaks out from the egg membranes.

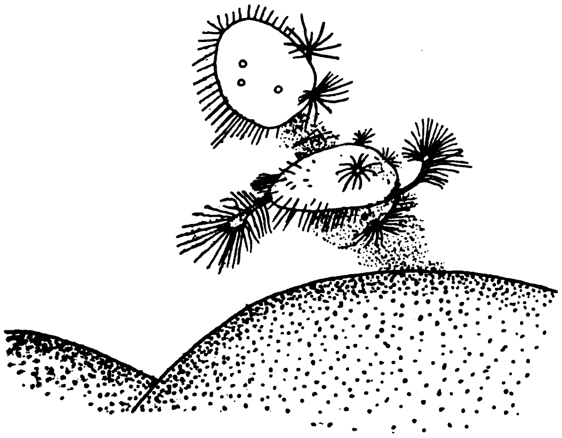

FIG. 17.

The first and the second polar bodies are markedly different: the first tends to remain more nearly spherical and to continue its radiating Heliozian-like activities; the second early assumes, somewhat the shape of a spindle, and is prone to send out long polar processes looking from the end view like stars and strongly suggesting *free astrospheres*, and from the side view somewhat like test-tube brushes. In later phases, the spindle may be much elongated, slender and with a marked astrosphere-like mass at each end, so that the entire figure is strangely like similar appearances in Caryokinesis.

With exceptional light, some of the spin-threads are seen to pass up to the egg membrane and to branch; others go to the surface of the egg. Here, as in the star-fish, the changes that take place, the making of new processes and the withdrawal and bending of old, makes it difficult to represent the actual appearances, even if it were possible to adequately express by black lines the optical effect made by these clear protoplasmic filaments, which bear as much resemblance to fine spun-glass-work as to any other common, gross object.

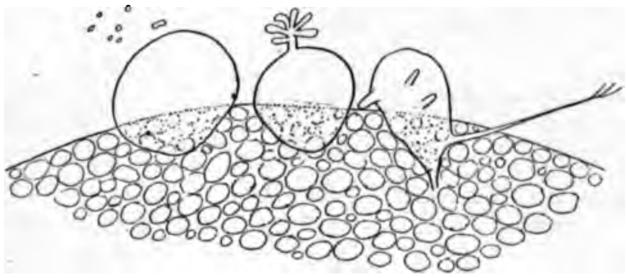

FIG. 18.

In a nudibranch mollusc, *Tergipes despectus?* there are often three polar bodies that remain in close association till the larva is a pyramidal, many-celled mass. In some cases a connection was seen, a changing process or processes, extending between a polar body and the egg, and between one body and another; generally, the connection escaped observation though the bodies acted as if held together. In the case shown in figure 18, the small objects near the largest polar body were seen to change position and may have been either foreign, or loose, particles, or else enlargements upon filose processes so fine as to escape detection with the 6 ocular and 2 mm. objective.

Similar objects near the next polar body proved to be a group of blunt, pseudopodia-like outgrowths borne upon a common stalk. From the remaining polar body similar, blunt processes projected in various directions, separately, and one very long process extended upward to the egg membrane, where it branched and seemed attached by its several side threads. This last polar body also sent out a process that apparently attached itself to the surface of the egg, which was still in an undivided state. In other cases, blunt processes. and long slender processes, were sent out and again drawn in; within a minute a long, slender process extended out from a polar body to the egg and seemed to join to it and later was represented by a tuft of short, pointed, contracted processes. In many cases the polar bodies showed amœba-like changes of form, with or without, pseudopodia: in one case, where there were but two polar bodies, they crawled over one another with much of the appearance of amœbæ, one of them having a tuft of pseudopodia.

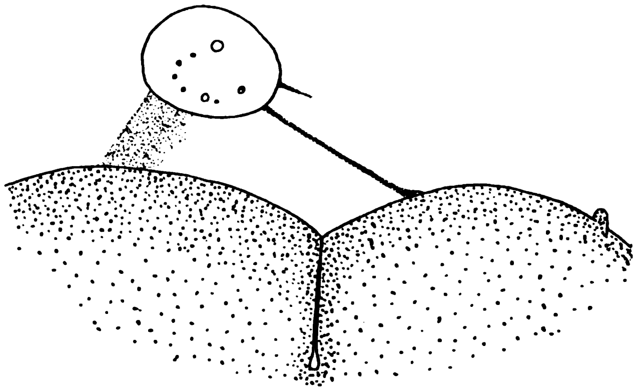

FIG. 19.

In a lamellibranch mollusc, *Nucula delphinodonta*, the formation and activity of the polar bodies was observed only in some eggs that were, probably, not fertilized and that did not develop beyond an incomplete first cleavage. The two polar bodies were seen to be connected by a cylindrical mass of clear substance and, as seen in figure 19, one polar body was seen connected to the egg by means of a long filament as well as by an extensive sheet of faintly refracting material similar to that seen in Cerebratulus.

In this case the cleavage had passed in toward the centre of the egg. The small eminence on one side illustrates one of the several ectosarcal processes that at first were much like protuberances found in Cerebratulus, and there giving rise to brushes of fine spin-threads. Here, however, such ectosarcal processes are followed by hernia-like protrusions containing yolk and indicating the abnormal state of the egg.

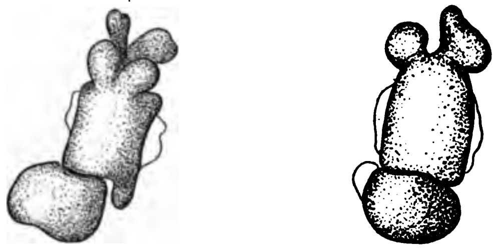

FIG. 20.

With the 8 ocular and 4 mm. objective, large star-like radiations and central refracting areas were seen near the first polar body as the second one was being formed. Comparing these with appearances seen with the same powers in Cerebratulus, there is no doubt that there were here, also, radiating branches of processes similar to those so common at the ends of the second polar body of Cerebratulus. The first polar body also showed very fine Heliozia-like radiations in one case. One polar body showed marked amœboid change of outline with a rounded, blunt pseudopodium.

Such amœboid changes of polar bodies are most pronounced in another lamellibranch, *Angulus tener*. As represented in figure 20, the larger, first

The environment in which Tripedalia was found is still more unlike that in which Cubomedusae have been taken heretofore. It was obtained in two localities, both of which were cut off from the main body of the Harbor, and so from the ocean, by peninsulas and islands covered with a growth of mangrove. The water was shallow and discolored with organic matter, and the bottom for the most part a black mud. The regions were virtually mangrove swamps. It was under the shelter of the overhanging mangrove boughs, among their half-submerged roots, that the Tripedalia was found thriving in large numbers. Conditions more strikingly unlike those of the pure deep sea could hardly be imagined.

T. cystophora is as quick and vigorous a swimmer as the species of Charybdea. In one case as many as 110 pulsations were counted in a minute. Its brownish-yellow color enables it to escape observation not infrequently in the discolored water.

C. Anatomy.

An abundance of material of both species was preserved in several ways and has furnished subject-matter during the past year for investigation of the adult anatomy of the Cubomedusae. The results have been embodied in a paper whose publication I hope will not be greatly deferred. Meanwhile the mention of one or two points may not be out of place.

The parts to which especial attention was given were the vascular lamellae, or cathammal plates, and the nervous system. The vascular lamellae, being definite areas where the two walls of the gastro-vascular system have come together and fused, are interesting because they show how the present structure of the gastro-vascular system of the Cubomedusae has come about from a simpler, undivided condition. It was hoped that their study might throw definite light on the affinities of the group. The results, however, were unsatisfactory, for while one part of the system of lamellae pointed strongly toward a relationship with such Hydromedusae as, for example, Liriope (Trachomedusae), another part, around the margin of the bell, gave evidence equally as good to the effect that the velarium was formed by the fusion of marginal lobes and that the view which considers it not homologous with the Hydromedusan velum is therefore correct. The question as to the affinities of the Cubomedusae must wait until the development is known.

The nervous system has been described by Claus,[1] and more recently in greater detail by Schewiakoff.[2] With the latter's conclusions as to the structure of retina and vitreous body of the complex eyes on the sensory clubs I am unable to agree. Schewiakoff's conception of the structure is in brief as follows:

a. The retina is made up of two types of cells, pigment and visual, which are figured as alternating regularly. The pigment cells are cone-shaped; the visual are spindle-shaped, with their nuclei lying in the swollen central portion of the spindle, at a lower level than the nuclei of the supporting pigment cells.

b. From the visual cells extend rod-like processes into the vitreous body (which lies between the retina and lens) lying in canals in the vitreous body.

c. In the vitreous body separate cone-shaped streaks of pigment overlie the pigment cells, which do not, however, form part of those cells.

d. Apart from these pigment streaks and the rod-like processes of the visual cells, the vitreous body is structureless, probably a secretion of the pigment cells.

The conclusions reached upon the same points by the study of the two Jamaica species are:

a. There is not good evidence of two distinct types of cells in the retina—cone-shaped pigment cells and spindle-shaped visual cells, with the nuclei of the latter at a lower level than those of the former.

b. The rod-like processes in the vitreous body exist, though not referable to a special type of cell in the retina.

c. The cone-shaped streaks of pigment in the vitreous body belong to the underlying pigment cells, in fact are direct continuations of them; and at their distal ends they are prolonged into fibrous processes lying in canals of the vitreous body exactly like the visual rod-like processes of Schewiakoff.

d. The vitreous body, over and above these "visual fibres" and "pigment streaks," is not a homogeneous secretion, but is composed of prisms of gelatinous, refracting substance, each with a denser central fibre. The size of the cross sections of these prisms corresponds with that of the cross sections of the majority of retinal cells. It is probable, therefore, that they represent the outer ends of retinal cells.

From the above it will be seen that I find in the vitreous body two structures in addition to Schewiakoff's visual processes—namely, similar processes from the "pigment streaks," and the prisms that make up the mass of the body. I am inclined to believe that the retina contains at any rate two and perhaps three kinds of cells, but that these are distinguishable only by that part of them which lies in the vitreous body, and are not distinguishable in the retina as two alternating types, as figured by Schewiakoff.

In another point also I am unable to agree with Schewiakoff. In one region of the sensory club is found a mass of peculiar large, closely-packed, polygonal cells, which he affirms to be ganglion cells as against Claus, who considers them supporting cells. In my sections they show nothing whatever to suggest a resemblance to ganglion cells. No processes could be made out, and the body of the cell consisted of a beautiful cytoplasmic reticulum with thickenings at the nodes of the rather coarse meshes.

The sensory organs in the proboscis of Tripedalia are simple cysts of ciliated epithelium lying in the gelatine. The long cilia support and keep in constant motion an otolith of ragged outline, in which no trace of cellular structure was found. This is the only case, so far as I know, of the occurrence among the medusae of a free, unsuspended otolith in a ciliated sac.

D. Development.

Females of Tripedalia were found with stomach pouches, or pockets, filled with developing ova, so that I am able to offer a few facts preliminarily on the development of the Cubomedusae. The mature eggs pass from the ovaries into the stomach pouches and there develop up to the stage of free-swimming planulae. In with them are found floating masses of cells, showing here and there a nematocyst, whose structure points clearly to an origin from the ovary also. These masses circulate about among the developing ova and serve for protection and apparently also for nutrition, since the cells are found vacuolated in masses from individuals containing well advanced embryos. All the eggs or embryos in one individual are at the same stage of development. Gastrulation was not observed in the living material, but sections show a stage in which central cells lie clearly marked off from a surrounding ring of smaller surface cells, and the probability is that these endodermal cells were formed by delamination. When the spherical mass is beginning to elongate into the ellipsoidal form of the planula a large migration of cells from the surface into the centre takes place, not limited to one pole. The relation of the central cells earlier seen, and of these inwandering cells, to the definitive endoderm was not made out. The young are set free from the parent as ciliated planulae, having pigment spots on the posterior end. The planulae swim about actively on the surface for a day or two, their motion being both translation and rotation. Then they gradually lose the forward motion and rotate on their own axis in one spot. At this point they settle down, and the pigment spots which were on the posterior surface are found to migrate into the interior. In a day or two they bud out two tentacles, and shortly afterwards two more, though young hydras with three and five tentacles were by no means uncommon. In this condition they lived for three weeks in the aquaria without undergoing further development.

Search for scyphistomas in the region where the jelly-fish were found was fruitless. The youngest specimens taken in the tow were of practically the adult structure, so that the important intermediate stages remain unknown. The youngest jelly-fish were interesting, however, in that only the middle tentacle in each group was developed, and that the sensory clubs were situated almost on the margin, and were not yet enclosed in niches.

Reference Letters in Figures.

af—furrow, on inner surface of exumbrella underlying the adradial ridge on the outer surface; *afr'*—furrow on outer surface, setting off the area in which the sensory niche lies; *ct*—canal of the tentacle; *go*—gastric ostium; *ifr*—interradial furrow, on outer surface; *n*—nerve ring, on the subumbrella; *pe*—pedalium; *ph*—phacellus; *pr*—proboscis; *r*—reproductive organ; *sn*—sensory niche; *su*—suspensorium; *sub*—subumbrella; *vc*—velar canals.

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[1] Ueber Charybdea marsupialis. Arb. aus d. Zool. Inst. d. Univ. Wien. Bd. II., Heft 2, 1878.

[2] Beitrage zur Kentniss des Acalephenauges. Morph. Jahrb. Bd. XV., Heft 1, 1889.

Notes on the Embryology, Anatomy, and Habits of Yoldia limatula, Say. By GILMAN A. DREW.

In this short abstract, attention will briefly be called to some points of interest in the development, anatomy, and habits of *Yoldia limatula*, a member of Pelsner's Order, Protobranchia. A more detailed description will follow at a later time.

EMBRYOLOGY.

The eggs are about .15 mm. in diameter, of a chocolate-brown color, and very opaque. They are laid free in the water, and are not encumbered by any kind of envelope. The polar bodies are lost soon after they are formed. The first cleavage results in the formation of sub-equal blastomeres. Subsequent divisions give rise to an epibolic gastrula in which there may be as many as sixty outer ectoderm cells. Some of the ectoderm cells wander into the interior, the entoderm cells divide, and at one side of the resulting cell-mass, a narrow tube appears, which opens to the exterior through the blastopore. As it has not been determined whether this tube is ectodermal or endodermal in origin, whether it represents a stomodaem or a primitive gut, it will throughout this description be referred to as the ventral tube.

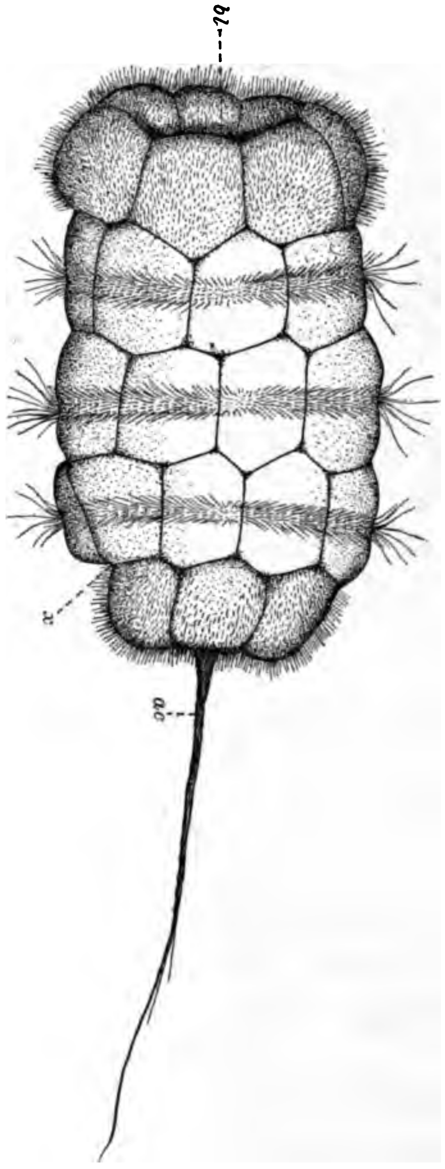

FIG. 10.

While these changes are taking place, about forty-two of the surface ectoderm cells enlarge, become vacuolated, and acquire cilia. The embryo also elongates, Fig. 10, becomes cylindrical, acquires an apical plate which bears a tuft of apical cilia, *ac*, and the outer cells, which will hereafter be referred to as test cells, arrange themselves in five rows. The blastopore, *bl*, occupies the end of the cylinder opposite the apical plate, and a depression, *x*, appears near the anterior end of what may now be referred to as the ventral side. The two end rows of test cells are entirely covered with fine cilia, and the three intermediate rows each bear a band of much longer cilia. The embryo now swims in more or less definite lines, rotating the while upon its longitudinal axis. During activity the apical cilia are bunched together into a sort of whip, and always precede the embryo.

Inside the test a new ectoderm is formed, probably from the ectoderm cells that wander in. At the age of about forty hours a few of these ectoderm cells elongate, and give rise to the shell-gland, which spreads over the dorsal portion of the embryo, but never forms a distinct invagination. At most it is only slightly concave when viewed from above, and soon becomes arched outward. These changes are accompanied by the formation of the mid-gut, a term that is not intended to include the ventral tube, which is of unknown origin. From the beginning, it is connected with the ventral tube, formed, as it were, as a continuation of the anterior extremity of the ventral tube.

From a time preceding the formation of the apical plate, a few cells of ectodermal origin have occupied an anterior position. These cells extend ventrally to the depression *x*, Fig. 10, and push in between the test cells. It was apparently from cells connected with this group that the apical plate was formed, and now, at about forty hours, other cells from this same group form two thick-walled pouches which open to the exterior between the test cells. These are the rudiments of the cerebral ganglia. Fig. 11 represents a transverse section of an embryo of fifty-eight hours, taken through the depression *x*, Fig. 10. The test, *t*, is shown to be composed of large, vacuolated cells, the walls between which are no longer very distinct. As this section cuts the anterior row of test cells, they are uniformally covered with cilia. The rudiments of the cerebral ganglia, *cg*, appear as two thick walled pouches. The wall of the anterior end of the mid-gut, *mg*, appears in section.

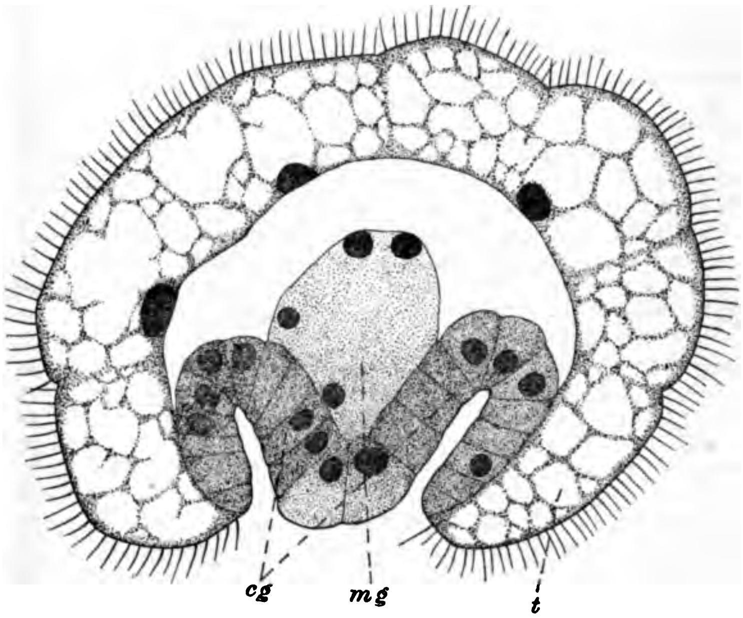

FIG. 11.

Fig. 12 represents a transverse section of another embryo at a corresponding stage, taken just in front of the second band of cilia. The shell gland, *sg*, has become arched upward, and is on the verge of protruding laterally to form the mantle. The mid-gut, *mg*, and the ventral tube, *vt*, are both shown in cross section.

This stage is of interest in showing the beginnings of the ectodermal thickenings that form the pedal ganglia, and the ectodermal invaginations that form the otocysts.

As the shell gland spreads out into the mantle, the embryo becomes slightly compressed laterally, the foot appears, and the visceral ganglia may be distinguished.

Fig. 13 represents a reconstructed embryo of one hundred and five hours. The test cells, *t*, are now very flat and much thinner than at an earlier stage. The shell, *s*, indicated in outline, is well formed. The anterior adductor muscle, *aa*, occupies a rather isolated position. The posterior adductor muscle, *pa*, has just made its appearance. The foot, *f*, is pretty well formed, and has running over and united to its tip, the ventral tube, *vt*, which opens to the exterior through the blastopore, *bl*, and is continuous with the mid-gut, *mg*. The embryo at this stage has acquired an anus *which has broken through into the upper part of the blastopore.* The liver, of which the left lobe, *ll*, is indicated, has made its appearance as evaginations of the mid-gut. The cerebral ganglia, *cg*, pedal ganglia, *pg*, and visceral ganglia, *vg*, are connected by commissures. The cerebral ganglia have been carried some distance from their point of origin, but are still connected with the exterior by the unpaired space, *r*, which has followed them in. The otocysts, *ot*, seem to be completely closed off, and each contains an otolith that stains deeply with haematoxylin, and a little later plainly shows concentric structure. As the otocysts have never been open to the exterior, development having taken place inside a closed test, the otoliths cannot be foreign particles.

At about the age of one hundred and five hours, or a little later, the embryo stops swimming, settles to the bottom, the cilia shrivel, the test cells break apart and go to pieces, and the animal is left in its clear, white shell, free upon the bottom. Beside the test, the casting includes the stalk that extends from the test to the cerebral ganglia, the apical plate and its connection, and the ventral tube from the blastopore to the position of the definitive mouth. The time occupied by these changes is very brief, only a very few minutes at most.

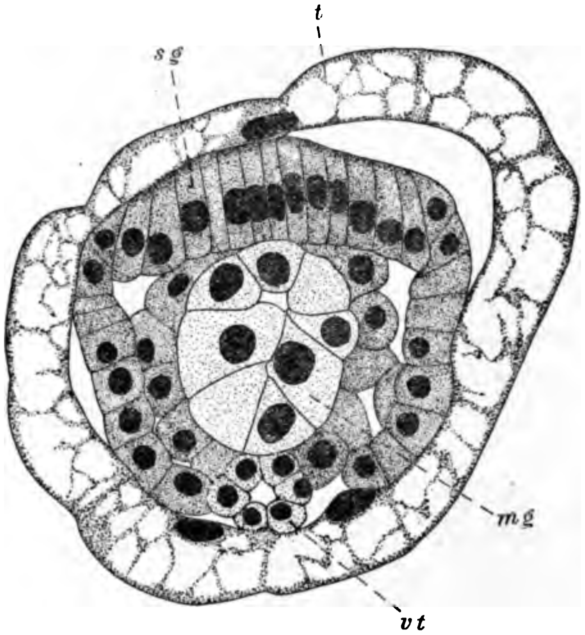

FIG. 12.

The foot, which at first is capable of only feeble movements, grows rapidly, and is soon very active. It is never moved slowly but is thrust out with a jerk and withdrawn quite as suddenly. Locomotion is chiefly effected by long and powerful cilia, which are arranged along the sides of the foot, and are very active whenever the foot is thrust out of the shell. The animal is thus enabled to glide over the surface on which it rests, but is unable to rise.

The gill rudiments appear in about one hundred and fifteen hours as thickenings of the posterior portion of the mantle. Each thickening becomes more pronounced, and is soon divided by a constriction into two parts, one dorsal the other ventral. This constriction deepens, the ventral portion broadens, is carried posteriorly, and in turn becomes divided into two parts. In the meantime the alimentary canal has lengthened, the stomach has enlarged, the left liver lobe has become larger than the right, and the foot has acquired a "sole," which roughly corresponds in shape and movements with the "sole" of the adult. Locomotion is still materially aided by the long and and powerful cilia. Fig. 14 represents a reconstruction an embryo twelve and a half days old, as seen from the right side, with t right shell valve and the mantle lobe removed. The powerful cilia the foot and gill, and the fine cilia that cover the surface of the body a project into the lumen of the alimentary canal, have not been indicate The lettering will enable the reader to identify the different parts.

The most striking peculiarities in the development of Yoldia are cc nected with the formation and disappearance of the test. So far as is know Dondersia is the only other Mollusk whose embryo has a locomotor test. short account of the embryology of *Dondersia banyulensis*, illustrated three figures, has been published by Pruvot.[7] The fully-formed tests of bo Dondersia and Yoldia consist of five rows of cells, all of which bear cili The cilia on the third row of cells (counting from the anterior) of Donde sia, and the second, third, and fourth rows of Yoldia are long and collect into bands which surround the embryos. The body of the embryo of Don ersia protrudes posteriorly during development. No such protrusion tak place with Yoldia. Each is provided with an apical plate and apical cili and in either case the test is finally cast off.

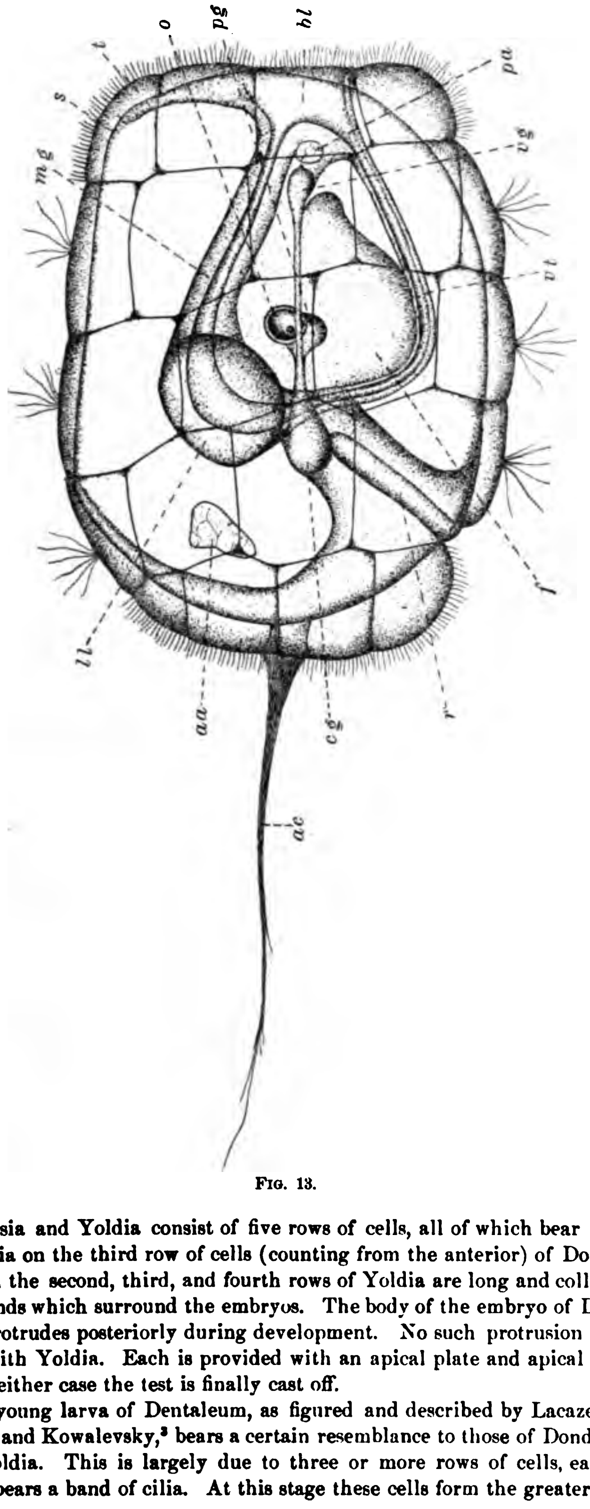

FIG. 13.

The young larva of Dentaleum, as figured and described by Lacaze-D thiers[4] and Kowalevsky,[3] bears a certain resemblance to those of Donders and Yoldia. This is largely due to three or more rows of cells, each which bears a band of cilia. At this stage these cells form the greater pa of the external surface of the embryo. As the body of the larva elongates posteriorly, these cells are crowded forward to form the velum, which, however, does not seem to be cast off.

Through these forms we may, perhaps, trace an homology between the test of Yoldia and the velum of other forms. In this connection it is interesting to notice that in a few forms the velum is known to be cast away. This was observed by Sigerfoos[8] for Teredo and by Wilson[9] for Polygordius.

The condition presented by the mouth and anus both opening through the blastopore is interesting. It may be that the blastopore offers the only available place for the anus to open, or it may stand in relation to forms on the one hand that have the blastopore persisting as the mouth, and, on the other hand, to forms that have the position of the blastopore occupied by the anus.

The formation of the cerebral ganglia from the walls of invaginations deserves special mention, inasmuch as it seems to be the first case reported for the Lamellibranchiata.

ANATOMY AND HABITS.

Yoldia limatula lives in soft mud or ooze, in which it moves about by means of its muscular foot, which is so modified that its edges can be turned outward and so form a first rate anchor. So efficient is the foot in burrowing, that a specimen placed upon the surface of the soft mud in which it lives, will completely bury itself with two thrusts of the foot. The foot is very sensitive and is moved with wonderful rapidity. In every way it shows itself to be nicely adapted for burrowing. It seems very hard to imagine that it could possibly be used as a creeping organ.

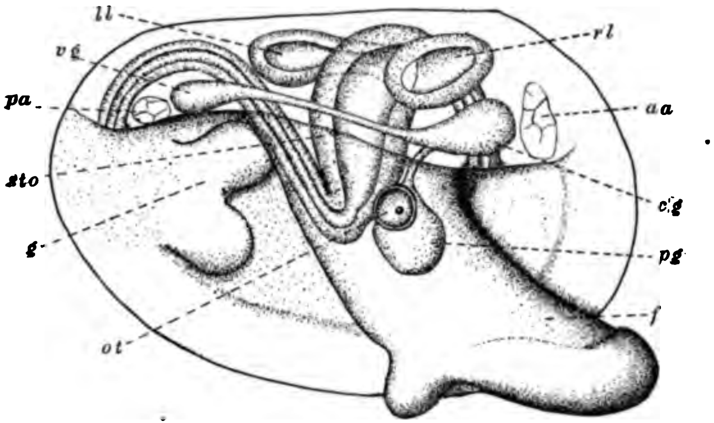

FIG. 14.

From the posterior part of each external palp there arises an elongated appendage, known as the palp appendage, which can be protruded to a distance considerably exceeding the length of the shell. This appendage is folded longitudinally to form a groove that runs from its tip to its point of attachment.

When the animal is feeding, the shell is slightly tipped ventrally from the perpendicular, and about two-thirds of its anterior end is buried in the mud. The palp appendages are thrust out of the shell, and one, at least, bends over and inserts its tip into the mud. The cilia lining its longitudinal groove immediately begin to elevate the mud, which is rich in living organisms. The stream of particles passing along the groove is large enough to be distinguished at a distance of some feet. In this way, foraminifers, ostracods, and even small lamellibranchs and gastropods, are passed along the groove, between the palps, and finally into the mouth.

Thus we find that Mitsukuri's surmise,[3] based on finding sand in the grooves of the palp appendages of preserved specimens, was right. The palp appendages are food collectors.

Experiments were tried to determine, if possible, the part taken by the gills in collecting food. No definite results were reached, but in no case was Kellogg's observation,[2] that the gills are extremely active food collectors, confirmed.

Considering the remarkable activity of the palps in collecting food, such activity for the gills seems rather unnecessary, and it would also seem that the pumping action of the gills, presently to be described, would seriously interfere with their performing such a function.

It is well known that each pair of gills is suspended from the body wall by a membrane, but little or no attention has been given the fact that this membrane is muscular. As the gills are composed of wide plates, they are sufficiently broad to span the spaces between the foot and the mantle lobes, Fig. 15, and behind the foot, unitedly to span the entire mantle chamber. Anteriorly the gills gradually diminish in size, and finally disappear. Posteriorly they are attached to the wall that separates the two siphons. The mantle chamber is thus divided by a movable partition into a ventral chamber, opening through the inhalent siphon, and a dorsal chamber, opening through the exhalent siphon.

In young specimens, in which the brown gills are visible through the shell, the movements of the gills may be observed. They are gradually pressed ventrally, probably by the blood forced into them, the water passing between the gill plates as they descend. This is followed by a quick contraction of the suspensory membranes, Fig. 15, *gs*, accompanied by a vigorous discharge of water through the exhalent siphon, as the dorsal chamber diminishes, and a corresponding influx of water through the inhalent siphon as the ventral chamber enlarges. The movements of the siphons, accompanying the movements of the gills, are very conspicuous, and have been mentioned by Brooks.[1] The movements are more or less rhythmic, the time varying with the needs of the animal.

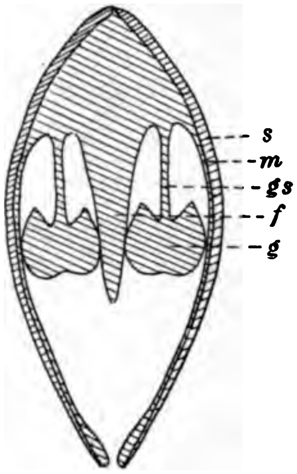

FIG. 15.

The currents of water are probably primarily for respiratory purposes, but they aid in clearing the mantle chamber from the dirt that is constantly finding its way in, and more especially from the faeces, which, being so largely composed of sand and mud, would otherwise drop into, and soon clog the mantle chamber. Beside creating currents of water, these movements may aid in causing the exchange of blood.

The inner, pericardial, and outer, mantle chamber, ends of each excretory organ, lie very near each other. Pelsner[6] has described the genital duct as opening into the excretory organ near its pericardial opening. In all the cases that I have examined, the genital duct bends ventrally, when almost in contact with the inner end of the excretory organ, meets the end and opens with it. The common opening of the excretory organ and genital duct into the mantle chamber is elongated antero-posteriorly and seems to represent a fusion of the two rather than an opening of one duct into the other.

No distinct separation into cerebral and pleural ganglia has been observed.

The otocystic canals have not been traced to the exterior, but they are distinctly visible near the otocysts. Their meaning is not clear to me, as the otocysts seem to be entirely closed off at an early age.

In closing, attention will be called to two sensitive areas on each mantle margin. These lie opposite the extremities of shell stripes that run from the beaks to the ventral margin, one anterior, the other posterior. The anterior area is in the form of an elliptical projection, and the posterior area is a flat expansion. Both, especially the anterior projection, are quite sensitive to mechanical stimulation. They are both entirely distinct from the organ of special sense described by Brooks.[1] Their special functions remain to be determined.

My thanks are due to Dr. W. K. Brooks, who has directed this work, and I wish publicly to acknowledge my indebtedness to my wife, who has materially aided me in securing, tending, and preserving specimens.

Zoölogical Laboratory, Johns Hopkins University,
Baltimore, May 1, 1897.

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Fig. 10.—External appearance of an embryo of forty-four hours. *ac*, apical cilia; *bl.*, blastopore; *x*, ventral depression.

Fig. 11.—Transverse section of an embryo of fifty-eight hours, taken through the depression *x*, Fig. 1. *cg*, pouches which form the cerebral ganglia; *mg*, wall of the anterior end of the mid-gut; *t*, test.

Fig. 12.—Transverse section of an embryo of fifty-eight hours, taken just in front of the second band of cilia. *mg*, mid-gut; *sg*, shell gland; *t*, test; *vt*, ventral tube.

Fig. 13.—Reconstruction of an embryo of one hundred and five hours. Cilia indicated only at the margins. *aa*, anterior adductor muscle; *ac*, apical cilia; *bl*, blastopore; *cg*, cerebral ganglia; *f*, foot; *ll*, left liver lobe; *mg*, mid-gut; *ot*, otocyst; *pa*, posterior adductor muscle; *pg*, pedal ganglion; *r*, pouch extending from the cerebral ganglia to the exterior; *s*, shell; *t*, test; *vg*, visceral ganglion; *vt*, ventral tube.

Fig. 14.—Reconstruction of an embryo of twelve and a half days, seen from the left side with the left shell valve and mantle lobe removed. *aa*, anterior adductor muscle; *cg*, cerebral ganglion; *f*, foot; g, gill; *ll*, posterior prolongation of the left liver lobe; *ot*, otocyst; *pa*, posterior adductor muscle; *pg*, pedal ganglion; *rl*, right liver lobe; *sto*, stomach; *vg*, visceral ganglion.

Fig. 15.—Diagrammatic transverse section of an adult animal, taken just in front of the posterior adductor muscle. *f*, foot; *g*, gills; *gs*, gill suspensory membrane; *m*, mantle; *s*, shell.

Some Activities of Polar Bodies. By E. A. Andrews.

The acceptance of the view that the polar bodies given off by the eggs of animals are but imperfect eggs incapable of fertilization, and having no part to play in the development of the true egg, has naturally tended to lessen interest in their fate. That they often remain attached to the egg for a long time, and that in certain insects, according to Henking, they may remain within the egg or go back again into it are facts that have seemed of no moment.

A recent paper[1] having shown that in certain Echinoderms the polar bodies as well as the egg are possessed of remarkable powers hitherto supposed to be limited to certain Protozoa, and that the polar bodies soon become, and may permanently remain, fused with the developing egg, makes it of great interest to inquire whether the polar bodies of other animals have such powers and such opportunities for possibly influencing the development of the egg.

It seems that in the star-fish and the sea-urchin, the egg both before and after fertilization acts very like many filose Rhizopods: the protoplasm is seen to project itself out from the mass in the form of delicate, flowing currents of living material that form filose pseudopodia. These thread-like processes have the power to unite with or separate from one another, to lengthen or to shorten, to become thick or thin much as do the pseudopodia of Gromia. By means of such living material spun out from the cells, all parts of the young organism are held together as one continuous mass of living matter; the continuity being established as fast as cell division tends to interrupt it.

The polar bodies act like the cells of the cleaving egg and from the first become organically continuous with the egg cells by means of living threads spun out from the polar bodies and from the egg.

In figure 16, the polar bodies are represented lying over the relatively large opening that leads into the cleavage cavity of the many-celled blastula. This figure is from a camera lucida sketch made, in 1894, with Zeiss ocular 8, objective 2 mm. and draw tube 170 mm. by G. F. Andrews, from the living blastula of the Asterias common at Roscoff, France. Under this magnification of more than one thousand diameters, the polar bodies are plainly connected with each other and with the surrounding cells of the blastula by delicate threads of protoplasm that constantly change. There are also characteristic tufts or brushes of more delicate threads sent out from each polar body; these also constantly change.

It will be noticed that the cells about the orifice also show threads stretching from one to the other as well as to the polar bodies.

On the threads protoplasmic masses flow along to or from the polar bodies or from cell to cell; and on the threads side spinnings may take place, producing such branching, rootlike tufts and anastomosing complexes as are partly represented in the figure.

The peculiar contractile powers of the material of these threads is illustrated in the figure in the case of a curved connective that joins the angle of one process to the angle of another. These processes extend from the two polar bodies to two separate cells on the margin of the orifice, or cleavage-pore, and the curved connective seems as if tending to draw the processes closer together by bending itself (compare 1, p. 382–3).

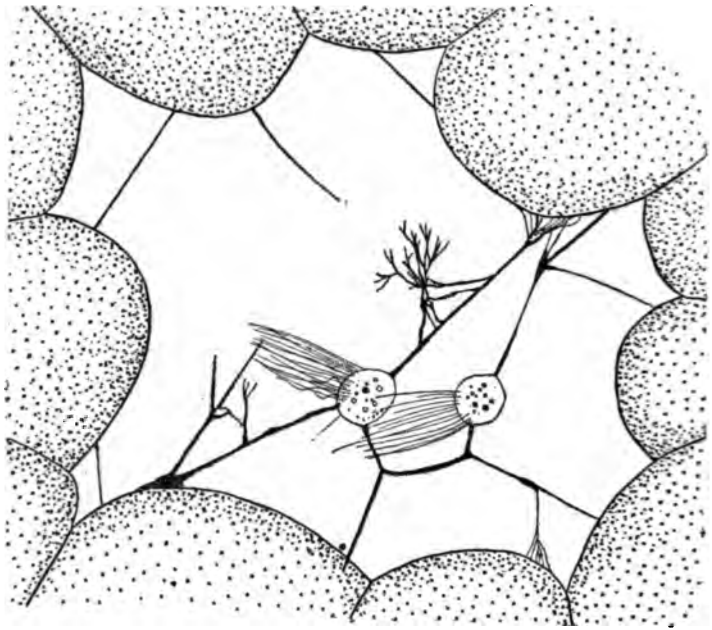

Fig. 16.

Passing over many significant facts, we note that the polar bodies may pass through the cleavage-pore into the interior of the blastula, and be connected with the complicated mass of threads joining the mesenchyme cells with the ectoderm and entoderm in the gastrula stage.

Thus in these animals the polar bodies long continue to act like Heliozoa, and acquire a living continuity with the embryo which may extend to the gastrula stage in such a way as to make them permanently part of the organism.

In the large Nemertean, *Cerebratulus lacteus* Verrill, I find some spinning activities of the egg and its cells, and most marked activity of the polar bodies. Soon after their formation the polar bodies send out delicate Heliozoa-like rays, and later characteristic star-like groups of processes that may develop into long proboscis-like outgrowths armed with lateral threads. From the first, the polar bodies are continuous with the egg and with one another by means of an exceedingly delicate film of material that sometimes shows fine threads and nodules within it, and seems living protoplasm rather than passive excretion or "slime."

In figure 17, the processes from the two polar bodies are indicated as seen under ocular 8, objective 2 mm. and draw tube 160 mm. and drawn, largely with the camera lucida. The egg was in the four-celled stage and about to divide again so that there were more than eight cells fifteen minutes later. The double membrane is indicated by two lines, some distance from the egg.

At this period the activities of the polar bodies have passed through their first phases and are gradually approaching their more permanent, later phases.

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[1] G. F. Andrews. Some Spinning Activities of Protoplasm. Journal of Morphology, XII, 1897.

A more detailed account of these will be given elsewhere, but we will here note that the polar bodies continue to adhere to one another and to the egg for a long time, even if the membrane be removed and they be exposed to the sea-water. When the larva becomes ciliated, the polar bodies break loose and float about in the liquid between the larva and its membranes, but they still adhere to one another, and are sometimes seen attached to the egg membrane. Probably they are lost when the larva breaks out from the egg membranes.

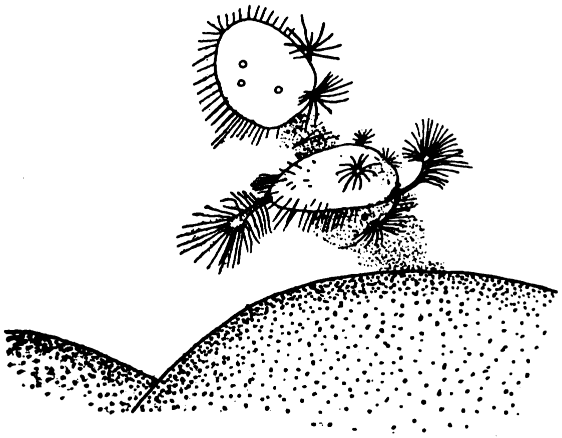

FIG. 17.

The first and the second polar bodies are markedly different: the first tends to remain more nearly spherical and to continue its radiating Heliozian-like activities; the second early assumes, somewhat the shape of a spindle, and is prone to send out long polar processes looking from the end view like stars and strongly suggesting *free astrospheres*, and from the side view somewhat like test-tube brushes. In later phases, the spindle may be much elongated, slender and with a marked astrosphere-like mass at each end, so that the entire figure is strangely like similar appearances in Caryokinesis.

With exceptional light, some of the spin-threads are seen to pass up to the egg membrane and to branch; others go to the surface of the egg. Here, as in the star-fish, the changes that take place, the making of new processes and the withdrawal and bending of old, makes it difficult to represent the actual appearances, even if it were possible to adequately express by black lines the optical effect made by these clear protoplasmic filaments, which bear as much resemblance to fine spun-glass-work as to any other common, gross object.

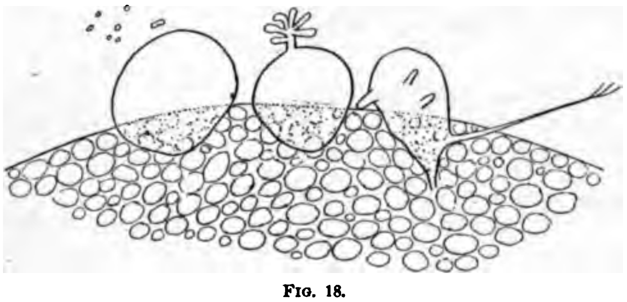

FIG. 18.

In a nudibranch mollusc, *Tergipes despectus?* there are often three polar bodies that remain in close association till the larva is a pyramidal, many-celled mass. In some cases a connection was seen, a changing process or processes, extending between a polar body and the egg, and between one body and another; generally, the connection escaped observation though the bodies acted as if held together. In the case shown in figure 18, the small objects near the largest polar body were seen to change position and may have been either foreign, or loose, particles, or else enlargements upon filose processes so fine as to escape detection with the 6 ocular and 2 mm. objective.

Similar objects near the next polar body proved to be a group of blunt, pseudopodia-like outgrowths borne upon a common stalk. From the remaining polar body similar, blunt processes projected in various directions, separately, and one very long process extended upward to the egg membrane, where it branched and seemed attached by its several side threads. This last polar body also sent out a process that apparently attached itself to the surface of the egg, which was still in an undivided state. In other cases, blunt processes, and long slender processes, were sent out and again drawn in; within a minute a long, slender process extended out from a polar body to the egg and seemed to join to it and later was represented by a tuft of short, pointed, contracted processes. In many cases the polar bodies showed amœba-like changes of form, with or without, pseudopodia: in one case, where there were but two polar bodies, they crawled over one another with much of the appearance of amœbæ, one of them having a tuft of pseudopodia.

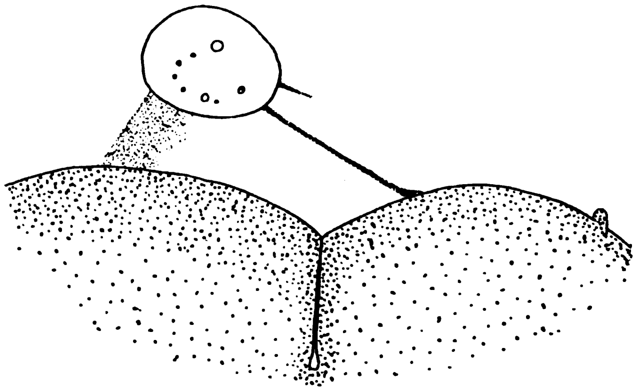

FIG. 19.

In a lamellibranch mollusc, *Nucula delphinodonta*, the formation and activity of the polar bodies was observed only in some eggs that were, probably, not fertilized and that did not develop beyond an incomplete first cleavage. The two polar bodies were seen to be connected by a cylindrical mass of clear substance and, as seen in figure 19, one polar body was seen connected to the egg by means of a long filament as well as by an extensive sheet of faintly refracting material similar to that seen in Cerebratulus.

In this case the cleavage had passed in toward the centre of the egg. The small eminence on one side illustrates one of the several ectosarcal processes that at first were much like protuberances found in Cerebratulus, and there giving rise to brushes of fine spin-threads. Here, however, such ectosarcal processes are followed by hernia-like protrusions containing yolk and indicating the abnormal state of the egg.

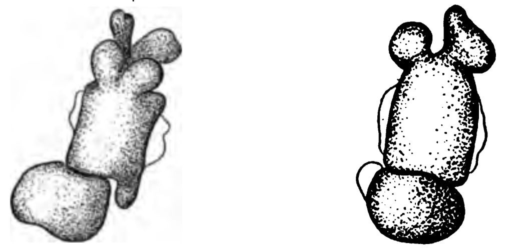

FIG. 20.

With the 8 ocular and 4 mm. objective, large star-like radiations and central refracting areas were seen near the first polar body as the second one was being formed. Comparing these with appearances seen with the same powers in Cerebratulus, there is no doubt that there were here, also, radiating branches of processes similar to those so common at the ends of the second polar body of Cerebratulus. The first polar body also showed very fine Heliozia-like radiations in one case. One polar body showed marked amœboid change of outline with a rounded, blunt pseudopodium.

Such amœboid changes of polar bodies are most pronounced in another lamellibranch, *Angulus tener*. As represented in figure 20, the larger, first polar body takes on a somewhat cylindrical shape, at a time when the second is rounded and not entirely free from the egg, and sends out blunt pseudopodia: the two bodies remaining closely appressed. Besides the rounded pseudopodia, which are represented as dark, there were also clear, delicate lateral sheets or lamellae of wavy protoplasm, which are indicated in outline. All these parts rapidly changed, as may be seen by comparing the left hand view with the right, an interval of scarcely a minute having passed between these two sketches of the same polar body. As these observations were made with the 6 ocular and 2 mm. objective, the failure to see spin-threads here does not disprove their existence; in one case there seemed to be something connecting the first polar body with the egg and passing like a filament between them: but the general character of these polar bodies was that of amœbæ and not that of filose rhizopods.

To sum up, we find that the polar bodies in certain representatives of the groups, Echinodermata, Mollusca, and Nemertini, show marked activities, differing in different groups and in different sub groups. In several groups the polar bodies have not only amœboid but strongly marked Heliozoan activities. The polar bodies in several groups remain vitally connected with one another and with the developing embryo, for some time after their extrusion.

How far these phenomena are normal, and how much of what is above recorded may prove to be pathological, cannot be at present decided, but in any event it has been shown that the protoplasm of polar bodies has powers hitherto unsuspected. These need not imply close relationship between polar bodies and Protozoa, but may serve to show that protoplasm expresses itself in radically the same characteristic, "protoplastic" way in Metazoa and in Protozoa. These new facts may be added to those recently presented in a comparative study of Protoplasm,[1] and help to bring us toward the new standpoints there reached.

October 18, 1897.

On the Leaf and Sporocarp of Marsilia. By DUNCAN S. JOHNSON.

[An Abstract.]

The following are some of the principal results of a study of the development of foliar structures in Marsilia quadrifolia, carried on during the past two years in the biological laboratory of this university.

The leaf begins its development with the formation, on the upper surface of the stem apex, of a typical two-sided apical cell. This apical cell continues its activity (Fig. 21) until about fifteen pairs of segments have been cut off, giving rise thus to a slightly tapering papilla-like organ lying nearly parallel to the stem and with its ventral or upper side facing the latter. The segments of the apical cell are nearly semicircular blocks which divide up soon by five nearly radial longitudinal anticlines, leaving a wedge-shaped marginal cell between the last two walls formed (Fig. 22).

In the lower or older segments each of the six divisions breaks up into many cells forming the vascular bundle, mesophyll, and epidermal structures (Fig. 22), of the cylindrical petiole. Between the mesophyll cells of this are formed the fourteen longitudinal air canals each broken into many short ones by the several transverse partitions formed in each segment.

In the younger segments of the tip, by the growth of the marginal cells in certain regions and the formation in these of many anticlines alternately parallel to each of its lateral walls, are developed the pinnæ or divisions of the lamina.

From the marginal cell of one of the lower segments is developed the sporocarp by the formation of a two-sided apical cell like that of the leaf. This cuts off segments, to the number of about twenty-four on each side, which break up by anticlines in a manner similar to those of the petiole of the leaf (Fig. 23), but forming six instead of five divisions besides the marginal cell.

The four or five oldest pairs of segments develop into the stalk of the sporocarp, a structure much like the petiole but of more compact tissue. The remaining segments form the so-called capsule containing the sporangia. In eight or nine pairs of these latter segments the basal marginal cells are surrounded and enclosed by the more vigorous growth of the other divisions of the segment. A row of macrosporangium mother cells and two rows of microsporangium mother cells is then formed from a part of each marginal cell, forming thus the eight or nine pairs of sori of the capsule, each with its own indusium formed partly from portions of the marginal cells themselves and partly from the above mentioned outgrowth ventrally of the other divisions of the segments. The walls of the capsule thus arise very differently from the pinnæ of the leaf, which, as we saw above, were developed by the continued formation of anticlines in the marginal cell.

The soral cavities or canals arise by the separation of the sporangium mother cells from the cells of the indusium lying median to them, beginning at the ventral surface, and continuing inward till all the sporangia formed from the mother cell stand out freely into the cavity formed by this separation of the cells.

The gelatinous ring seems to replace vascular tissue in one part and mesophyll in another.

In conclusion, then, Marsilia quadrifolia agrees with most other Leptosporangiates in the origin of the leaf, in the growth of this by a two-sided apical cell and in the formation of the pinnæ by the continued activity of the marginal cells in certain regions.

The sporocarp is a fertile portion or branch of the leaf arising from an apical cell like that of the leaf itself formed in a marginal cell of the petiole. But the fertile branch does not develop any structure homologous with the lamina of the sterile branch, the capsule being morphologically the swollen end of the petiole, if we may call it such, of the fertile branch. The tissue surrounding the sori is a true indusium arising by the outgrowth of the cells of the ventral surface of the branch to surround the sori in which the microsporangia are derived from sister cells of the macrosporangium mother cells, and not from segments of the apical cell of the latter as described by Russow and Büsgen.

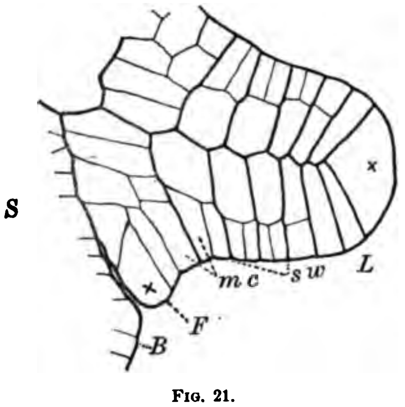

FIG. 21.

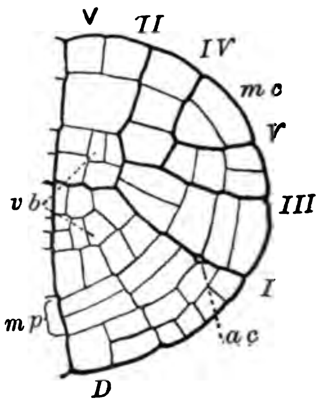

FIG. 22.

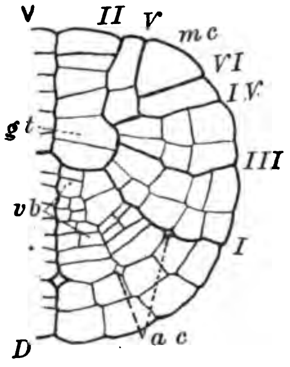

FIG. 23.

EXPLANATION OF FIGURES.

Abbreviations:—AC, air canal; B, axillary branch; D, dorsal; F, sporocarp; GT, tissue of gelatinous ring; L, leaf; MC, marginal cell; MP, mesophyll; S, stem; SW, segment wall; V, ventral; VB, vascular bundle; X, apical cell; I, II, etc., successive anticlines formed in the segments.

FIG. 21.—Approximately horizontal section of a young leaf, with the apical cell of a sporocarp just formed.

FIG. 22.—Half of transverse section of young petiole of a sterile leaf.

FIG. 23.—Similar section of a young capsule.

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[1] G. F. Andrews. The Living Substance. Ginn & Co., 1897.

JAMES ELLIS HUMPHREY. — FRANKLIN STORY CONANT.

1861-1897. 1870-1897.

MINUTES OF A MEMORIAL MEETING.

Baltimore, October 3, 1897.

On Sunday, October 3, 1897, a meeting was held in the Donovan Room McCoy Hall, to commemorate the character and services of Professor Humphrey and Dr. Conant, whose lives were sacrificed in the prosecution of scientific researches during the summer of 1897.

President Gilman presided, and Dr. E. A. Andrews acted as Secretary of the meeting. Brief addresses were made by Professor Brooks, Professor Howell, Professor Welch, Mr. Fredholm, and others.

The following minutes and resolutions were adopted:—

Minute.

The following minute, prepared by Dr. B. W. Barton, lecturer in Botany, was read by him, and adopted by the meeting:

The Faculty and Students of the Johns Hopkins University have assembled with other friends of James Ellis Humphrey to express their sorrow at the loss they have sustained in the untimely death of their colleague, instructor and companion; a teacher in the army of science who died at his post in the discharge of unusual and difficult duties.

Professor Humphrey's value in the department of instruction under his charge in this University increased rapidly and steadily during his three years of service until he became the essential factor in its success. Pupils and colleagues soon learned to draw upon his well-ordered store of knowledge and to trust his judgment which ever proved sound and accurate. His boundless patience and care as a teacher gave assurance and encouragement to his pupils who soon learned to seek his advice in well-founded confidence of ready and willing response. Nothing which promised to be helpful to others was a trouble. Few have exemplified better than he the beauty of orderliness. Books, papers, instruments and his store of knowledge were all at his ready command, and nothing with which one had to do, either of facts or things tangible, was ever out of place.

He was a ready writer and a well-known contributor to botanical literature, and all his work is marked by minute care, as well as by broad culture and great power for original research and reflection, for he was broad and liberal in all his thoughts and in all his dealings, and nothing that he undertook was left without new additions with permanent scientific value. In matters doctrinal he accepted that which was most evidently true—in politics he had broken all hampering ties and aimed to be governed by principles which promised the greatest good.

To overwork, and a consequent lowered state of health, may probably be attributed the lamentable catastrophe of his death. In spite of warning and against the wishes of one whose pleasure and comfort were always of supremest moment, he went because the duty of going seemed too plain to resist, and then he fell;—a loss to the University which the memory of his character and example lightens but little; a loss to his more intimate friends which nothing but the hand of unfeeling time will remove; a bereavement to those yet nearer to him upon which we must not intrude, except in sympathy.

The meeting resolved that copies of this Minute be sent to the Massachusetts State Agricultural Experiment Station, at Amherst; to the Trustees of the Johns Hopkins University; to the Johns Hopkins University Circulars; to the family of Professor Humphrey, and to the department of Botany in Harvard University.

Minute.

The following minute, presented by Professor Howell, was also adopted:

We, the friends and companions, and instructors of Franklin Story Conant, having assembled to express the sorrow with which we have heard the sad news of his death, wish to record our love and esteem for the generous, warm-hearted friend who, in all the relations of life, proved himself worthy of the utmost honor and confidence;

We, who have worked at his side in our laboratories, recall his steadfast earnestness in the pursuit of knowledge, and the encouragement we have found in his bright example;

We, who have been his instructors, remember him as one who bettered our instruction and enriched all that he undertook by sound and valuable observations and reflections;

We mourn the untimely loss of one who had shown such rich promise of a life full of honor and distinction and usefulness, but we remember with pride that his end was worthy of one who had devoted it to the fearless pursuit of truth, and to generous self-sacrifice and noble devotion to others;

We therefore Resolve,

That we prize the lesson of the noble life and death of Franklin Story Conant,

and we Resolve,

That copies of this resolution be sent to the Johns Hopkins University Circular, to the Faculty of Williams College, and to the mother of Dr. Conant.

It was also further Resolved by the meeting, that the following Associations be requested to elect each a member to serve on a Committee of seven to devise and execute, as soon as possible, some fitting permanent Memorial to Professor Humphrey and Dr. Conant:

1. The Young Men's Christian Association of the Johns Hopkins University.
2. The Graduate Students' Association of the Johns Hopkins University.
3. The Naturalists' Field Club of Baltimore.
4. The Botanical Club of the Maryland Academy of Arts and Sciences.
5. The intimate friends of Professor Humphrey and Dr. Conant now resident in Baltimore.
6. The members of the Jamaica Marine Laboratory.
7. The members of the Biological Laboratory of the Johns Hopkins University.

JAMES ELLIS HUMPHREY.

(A Sketch.)

By J. S. Kingsley and B. W. Barton.

James Ellis Humphrey, the oldest son of James and Susan (Cushing) Humphrey, was born in Weymouth, Mass., August 5, 1861. He received his early education in the schools of the town, so far as school education was concerned, but to his father he owed far more than to his teachers, for to him was due that love of literature and especially of poetry which was such a marked characteristic in him. Those who have attended the botanical seminaries which he conducted know how he labored to impress upon his students, not only the facts of his science, but an appreciation of the grand in poetry and prose. His indebtedness to his father did not end with this. His father—lawyer and judge as he was—knew the value of language, and it was to his drill in the correct and proper use of words that the young man owed that facility and felicity of expression which all who have read his papers or have heard his lectures, could not fail to notice.

At the age of sixteen he graduated from the Weymouth High School, and notwithstanding his youth, he was immediately appointed master of the grammar school at North Weymouth, near his home. During the year that he retained this position he was most successful as a teacher, maintaining perfect order, and interesting and inspiring his pupils in just the same way that he did in his later University work.

Next followed a business experience in the employ of the Prang Educational Company, a corporation dealing in supplies for schools and colleges, and here he was brought in contact with people who stimulated him to further study and to study in scientific lines. One of his vacations was spent in study at the Martha's Vineyard Summer Institute, where, under the direction of the Rev. J. D. King, he received an introduction to the great group of Algae. On his return he fitted up a little laboratory at his home, and every spare moment was devoted to collecting the sea-weeds in that most productive place, the Weymouth Fore River, which ran to the sea almost before his father's door.

Soon there came the realization that science for him possessed more attractions than business, and that in order that he might realize his ideals, he must not depend upon studious evenings and holidays spent without direction. So there followed a decision to enter college and in the autumn of 1882 he was enrolled as a special student in the Lawrence Scientific School of Harvard University. At first, he was like many other students. He went to College for a fixed and definite course and he felt that he had no time to waste on those subjects which did not bear directly upon his chosen work. He soon found out that the despised non-scientific studies had a real value for him and that the degree which the University offered to those who had completed the prescribed course was not to be thrust lightly aside. So he redoubled his efforts and so indefatigable was he that he not only passed all the entrance requirements but he also did the four years of required work in three, receiving at the Commencement in 1885 the degree of Bachelor of Science. That this work was not done in a superficial and slipshod manner is shown by the fact that his diploma states that the degree was granted him with the distinction "summa cum laude," the highest praise the University confers

While an undergraduate he carried on two pieces of investigation. One, the results of which were never published, was a study of the structure of the eyes of the starfish. The other, which was printed by the American Academy of Arts and Sciences, formed his dissertation for obtaining the bachelor's degree. It dealt with the process of formation of the peculiar perforations which occur in the frond of the Alga, Agarum-Turneri.

Immediately after graduation he received an appointment as assistant in botany, under Professor George L. Goodale, in Harvard University, and his first experience as an instructor demonstrated the thoroughness of his preparation and showed the stuff of which he was made. When the college year began Professor Goodale was abroad, and so the whole work of organizing the courses and of giving the lectures, as well as conducting the laboratory work, not only in the college, but in what was then familiarly known as the "Annex," devolved entirely upon the young and inexperienced assistant. However, he met every demand made upon him, and carried on all the work alone for three months with signal ability.

In the summer of 1887 Mr. Humphrey was appointed instructor in botany, in the University of Indiana, and during the year which he occupied this position his work fully bore out the prediction made by Professor Farlow in his letter recommending him for the place, to the effect that in his lectures he would "talk botany and not about botany." It was in Indiana University that I first became acquainted with him, and the acquaintance soon ripened into an intimacy which only increased as time went on. One could but be attracted by his enthusiasm and by his ingenuous manners, and many were the lasting friendships he made among the group of strong young men whom President Jordan had brought together as his faculty.

The next year he accepted an appointment in the State Experiment Station at Amherst, Mass. Upon his arrival there he found little in the way of equipment. But funds were freely granted and as the result of his good management the Station became possessed of a well appointed laboratory. His investigations were directed at once along a so-called practical line. His work upon the Black Knot of the plum and the diseases of cucumbers and potatoes was done with such care and so well presented in his published papers upon these subjects as to form a solid and most valuable contribution to this department of botany and to horticulture.

In the evenings and holidays of these years at Amherst, Mr. Humphrey continued his studies in pure science as a candidate for the doctor's degree at Harvard. He chose for the subject of his dissertation a group of obscure aquatic fungi known as the Saprolegniaceæ, and his paper upon these forms, published by the American Philosophical Society, will long remain a classic. He not only monographed all known American species of the group, but he greatly increased our knowledge of their structure and development; and his work upon them is especially noticeable from the fact that in his studies he employed the recent cytological method which, up to that time, had been entirely ignored by American botanists. Upon the presentation of this dissertation and the passing of the customary examination, he received the degree of Doctor of Science, from Harvard University, at the commencement in 1892.

In January, 1893, Dr. Humphrey resigned his position at the Amherst Station, and started upon his first trip to Jamaica. Here he worked and collected for several months in and around Port Antonio, where he studied especially the sea-weeds preparatory to a projected exhaustive study of Tropical Algae. Much of the material which he collected upon this trip remains to be worked up, but specimens from it have been distributed in several of the series of exsiccatae.

Upon his return from Jamaica he settled down to work with characteristic industry upon a translation of Zimmerman's Botanical Microtechnique, which was published by Henry Holt & Co. during that year. This work was, however, more than a translation, for upon nearly every page Dr. Humphrey has left his impress. The task was undertaken, too, without promises of reward other than interest in promoting the science by contributing a valuable work to English speaking botanists, who might be unable to avail themselves of the use of the German edition.

Later in the same year (1893), Dr. Humphrey sailed for Europe, and entered the laboratory of Professor Edward Strasburger, at Bonn. Here, under such a master, his studies were naturally turned in the direction of cytology and embryology, and after his return they continued in the same line as shown by the series of beautiful researches published in the Annals of Botany and elsewhere.

As a mark of honour from the German botanists, he was made a member of the Deutsche Botanische Gesellschaft, of Berlin, on the fifteenth of May, 1894.

In the fall of that year (1894), Dr. Humphrey was appointed fellow by courtesy, in the Johns Hopkins University. The next year he was made lecturer in botany, and last spring, just before he sailed again to Jamaica, he was advanced to the position of associate professor of botany in this institution.

His life in Baltimore was no less a busy one than we find it to have been elsewhere. Besides the regular course of lectures at the University upon the Comparative Morphology of reproduction, he superintended daily laboratory work and often took part in field excursions which were most interesting and successful under his guidance.

During the early part of last winter he gave a course of lectures upon the history of botany to a popular audience. The full attendance at these lectures to the very last, where without so much as a map or a diagram, he was able to hold hour after hour from week to week, the attentive interest of his hearers, must testify to his skill in selection and the aptness in mode of presentation of a subject generally considered a dry one among laymen.

On Friday evenings he conducted a course of reading at his home. At the meetings of this seminary, some book of conspicuous interest or importance to botanists was read aloud by one or other member and discussed by all with a pleasant informality, which made of Friday evening a bright spot in the week's work. Last winter, Warming's Ecological Plant Geography occupied the time of the Seminary.

The quiet interest which Dr. Humphrey took in the Naturalists' Field Club, and the good method of some of his suggested plans, had begun to show results towards attaining one of the chief aims of this society, that, namely, of a better acquaintance with the flora round about Baltimore, and in securing a representative collection of plants. The flowering plants being already in other hands he had begun a collection of the cryptogams for this purpose.

The summer vacation of 1896 he spent at Woods Holl, where he conducted the instruction in botany in a manner which elicited expressions of satisfaction and praise from various quarters.

In the intervals of these varied details of his ordinary occupation, he pushed on with plodding diligence in the line of more advanced work. During the winter of 1894 and 1895, he completed two studies begun in Germany with Strasburger—the one on the Nuclei and Centrosomes in Osmunda, Allium and Pellia; the other on the Development of the Seeds in Scitamineae. Both of these papers have appeared in the Annals of Botany. For some time past he had been working upon the embryology and development of the seed in Zingiberaceae, and for the prosecution of this work he had collected valuable material during the past summer in Jamaica. Within the past year he had also begun observations upon chalazogamy, making use for the purpose, of Morus, Platanus, Maclura, Alnus, and other plants of this region.

Incidental to one of the much mooted botanic questions of the day, he gave a part of last spring to a careful study of the reduction of the chromosomes, using Larix as his subject.

Withal, he found the time to collect and make drawings of a number of Saprolegniaceae and other related fungi with a view of adding some day to the value of the published monograph on this subject to which reference has already been made.

In many ways Dr. Humphrey was an ideal man. He was the very soul of purity and honesty. He had high ideals, and was outspoken in his opinions of dishonesty in business or intellectual matters. A piece of slovenly work excited his disgust. He was strong in his friendships and faithful to his friends. He was strongly optimistic—no matter how dark the moment, he could always see blue sky ahead. He was an honest, careful worker and he thought clearly upon the subject of his studies. He was social, and he enjoyed good society as much as any man could. He had a keen appreciation of humour, and the artistic side of his nature was highly developed.

The following is a list of Dr. Humphrey's published works:

1886: On The Anatomy and Development of Agarum Turneri. *Proc. Amer. Acad. A. & S., June*, 1886, *p.* 195, 1 *pl.*
1887: The Preparation of Agarics for the Herbarium. *Bot. Gaz., Vol. XII*, 1887, *p.* 271.
1888: Potato Scab. *Rep. Mass. Agric. Expt. Sta.*, 1888, *p.* 131, 1 *pl.*
1889: Mildews. *Mass. Hort. Soc.*, 1889, *pp.* 1–11.
—— Fungous Diseases of Plants. *Bull. No.* 6, *Mass. Ag. Expt. Sta., Oct.* 1889, *p.* 9.
—— A General Account of the Fungi. *Mass. Ag. Expt. Sta. Rep.*, 1889, *pp.* 195–230.
1890: Notes on Technique. *Bot. Gaz., Vol. XV*, 1890, *p.* 168.
—— Black Knot of Plum, Mildew of Cucumber, etc. *Rep. Mass. Ag. Expt. Sta.*, 1890, *p.* 200, 2 *pl.*
1891: Treatment of Fungous Diseases. *Bull. No.* 39, *Mass. Ag. Expt. Sta., April*, 1891, *pp.* 1–12, 5 *figs.*
—— Protoplasmic Physics. *Amer. Nat., Vol. XXV*, 1891, *p.* 376.
—— Comparative Morphology of the Fungi. *Amer. Nat., Vol. XXV*, 1891, *p.* 1055.
—— Notes on Technique. *Bot. Gaz., Vol. XVI*, 1891, *pp.* 71–73.
—— Some Diseases of Lettuce, etc. *Bull., No.* 40, *Mass. Ag. Expt. Sta.*, 1891.
—— The Rotting of Lettuce. *Mass. Ag. Expt. Sta. Rep.*, 1891, *pp.* 218–248, 1 *pl.*
1892: Amherst Trees. *Amherst, Mass.*, 1892, *pp.* 1–78.
—— Fungous Diseases and Their Remedies. *Mass. Hort. Soc., Jan.*, 1892, *p.* 1.
—— The Saprolegniaceae of the United States. *Amer. Phil. Soc., Nov.* 1892, *p.* 63, 7 *pl.*
—— Rep. of Mycologist. *Mass. Ag. Expt. Sta.*, 1892, *p.* 1, 5 *pl.*
1893: On Monilia Fructigena. *Bot. Gaz., Vol. XVIII*, 1893, *p.* 85, 1 *pl.*
—— Botanical Microtechnique (from the German by Zimmerman). *New York*, 1893, *pp.* 1–296.
1894: Where Bananas Grow. *Pop. Sci. Month., Vol. XLIV*, 1894, *p.* 486.
—— Neucleolen und Centrosomen. *Berich. der Deutschen. Bot. Gesell., Bd. XII.*, 1894, *p.* 108, 1 *pl.*
—— Nucleoli and Centrosomes. *Ann. of Bot., Vol. VIII*, 1894, *p.* 373.
—— Eduard Strasburger. *Bot. Gaz., Vol. XIX*, 1894, *p.* 401, 1 *pl.*
1895: Some Recent Cell Literature. *Bot. Gaz., Vol. XX*, 1895, *p.* 222.
—— Some Constituents of the Cell. *Ann. of Bot., Vol. IX*, 1895, *p.* 561, 1 *pl.*
1896: Botany and Botanists in New England. *New England Mag., Vol. XIV*, 1896, *p.* 27, 2 *pl.*
—— On the Development of the Seed in the Scitamineae. *Ann. of Bot., Vol. X*, 1896, *p.* 1, 4 *pl.*
—— Some Modern Views of The Cell. *Pop. Sci. Month., Vol. XLIX*, 1896, *p.* 603.
—— A University Celebration in Germany. *Amer. Univ. Mag., Nov.*, 1896.

Dr. Humphrey was an associate editor of "Zeitschrift für Pflanzenkrankheiten," a frequent contributor of notes on American botany to "Botanisches Centralblatt," and of specimens to the "Phycotheca Boreali Americani," of Collins, Holden, and Setchell.

FRANKLIN STORY CONANT.

[A Sketch.]

BY GEORGE LEFEVRE.

Franklin Story Conant was born in Boston on September 21, 1870. He was the youngest child of Farley Franklin and Emily Wilbur Conant, both of Boston and both descended from the old Puritan stock that settled New England. Ten generations back, Roger Conant, the first of the name to come from England to America, was the earliest governor of the settlers of Salem, Mass., holding the position for three years before the arrival of John Endicott.

His earliest education was obtained in the Public Schools of Boston and also of Wellesley Hills, where his family removed when he was about ten years of age. Here he attended the High School for two years but completed his course in Winchester. It was at this place that he became a member of an evangelical church, being at the time fifteen or sixteen years old. That the noble traits of his character and the influence for good which so marked his later life, were already developed to a high degree, is shown by the following extract from a recent letter of one of his schoolmates of that period, whom he had not seen for several years. "No one I have ever known has been to me and will always be a greater satisfaction and inspiration to think of. A splendid strength, the strength of fine power, of noble purpose, above all of a singular high-mindedness, used to make his very presence uplifting—his very memory. I have never seen youth so radiantly consecrated, and I have looked forward to his future with confidence and even with reverence. From year to year I have thought of what his life was going to mean to the world. Now that I try to realize that he has lived his life, I can see that he could not, by living many years, have given us anything more precious than what he has given. I thank God that I have known him."

Those who knew him will recognize that the expression, "a singular high-mindedness," strikes the keynote of his life and character. How well did he fulfil the promise of his earlier youth!

On leaving Winchester, he spent a couple of winters in the South, entering the University of South Carolina at Columbia, S. C., where his rank as a student was unprecedentedly high. While there, as indeed throughout all his student years, he was much interested in the College Y. M. C. A. work, being for a time President of the College Association. Returning home he took up the study of Greek under a tutor, and entered the Sophomore Class of Williams College in the fall of 1890. Here he distinguished himself at once, showing perhaps at first more aptitude for languages than for scientific studies, and in after years when his time was almost wholly given to the latter, he retained an accurate and extensive knowledge of the classics, upon which he was ever drawing for illustration.

It was owing to the personal interest and kindness of Professor S. F. Clarke, of the Williams Faculty, that he finally decided after characteristic deliberation to enter upon the study of Biology as his life-work. I cannot do better in speaking of his college career, his already mature and brilliant mind at that time, his pure influence and the love and esteem in which he was held alike by instructors and fellow-students, than by quoting here a letter from his former teacher and friend, Professor Clarke. After coming to Williams College, "It was," he says, "quickly evident to all his Instructors that a man of unusual ability had joined their classes. Later the examinations proved that Conant was decidedly leading his class in every department; in languages, in mathematics, and in science. In his work in the General Biology, I well remember that he was always carefully prepared, his answers were noticeable for their comprehensiveness and accuracy; he expressed himself vigorously and with remarkable clearness, and his examination books surpassed any I have known in showing clear thinking and good English. He became more and more interested in Biology, occasionally spending an hour at my study in talking upon biological problems. He entered the Elective Course in Biology in his Junior year, and continued it to the end of his college course."

"Before he graduated he decided to elect Biology as the field of his life-work, and in the furtherance of that plan passed the first year after graduation in pursuing his work in Biology at Williams. In the summer of 1893, he went to Wood's Holl, Mass., where he attended some of the advanced courses at the Marine Biological Laboratory. Throughout his college life he held his position as first in his class, being graduated as Valedictorian."

"I know I am safe in saying, that, for the three years he was here, no one has ever attained with us a higher scholastic rank. His influence in college was always of the best, it being used for everything which made for the good. He was a man of high ideals, possessed of a strong sense of duty, and was markedly pure of mind. He won the esteem of everyone in college, and to many of us he was a dear friend."

The subject of his Valedictory address, it might be mentioned, was "Moderation," a characteristic choice which represented the maturity and temper of his personality. It was a plea for the adjustment and balance of the conduct of life and the curbing and suppression of intolerance.

To prepare himself for his profession, he decided to enter the Johns Hopkins University as a candidate for the degree of Doctor of Philosophy, and with that end in view, in the Spring of 1894, he joined the Marine Zoological Laboratory of this University then stationed at Beaufort, N. C.

The choice of his master was carefully and thoughtfully made, and was in itself a tribute to Professor Brooks' reputation as a distinguished naturalist and successful teacher. And between the teacher and the pupil there early developed a sincere and lasting friendship. His great natural ability, his earnest enthusiasm, his untiring industry and devotion in work, and over all his strong personality soon won for himself recognition, and the warm admiration and friendship of his instructors and associates.

From Beaufort he went in the latter part of the summer to the laboratory of the U. S. Fish Commission at Wood's Holl, Mass, and in the fall began his work at the Johns Hopkins University. During the first year he carried on an investigation on the anatomy and development of Chaetognaths, a study begun at Beaufort; and he published in the Spring a paper on a "Description of Two New Chaetognaths."

The following summer found him again in Beaufort and Wood's Holl, and on returning to the University he received the appointment to the University Scholarship in Biology for the year 1895-96. The results of that winter's work were embodied in a preliminary article, "Notes on the Chaetognaths," and also in a paper entitled "On the Accelerator and Inhibitory Nerves to the Crab's Heart," an investigation conducted by himself and Mr. H. L. Clark in the Physiological Laboratory of Professor Howell.

A Fellowship in the Johns Hopkins University was awarded to him in June, 1896, soon after he started for Jamaica as a member of the Marine Laboratory, established at Port Henderson in Kingston Harbor. Abundant and good material was collected for the study of the structure of the Cubomedusae, a research which was later to become his thesis for the doctor's degree.

On his return to this country he spent a short time at the Marine Biological Laboratory at Wood's Holl, and during the following winter and spring devoted himself chiefly to the preparation of his thesis. The results of this work are contained in an able and excellent paper, of which a preliminary notice is printed in this Circular. All of his scientific writings are characterized by a remarkable clearness and conciseness of style, by the greatest painstaking care and accuracy and attention to details, and they show a breadth and comprehensiveness of understanding of the facts with which he dealt, that denote clear, well-balanced thinking.

In June, 1897, he received the degree of Doctor of Philosophy, and was also appointed to the Adam T. Bruce Fellowship for the ensuing year. He was not present, however, to receive his diploma in person, as immediately after the close of his examinations he started on the ill-fated expedition to Jamaica which was destined to end his life so full of brilliant promise and take from us a well-beloved friend and companion.

His object in returning to the tropics was to carry on a physiological research on the nervous system of the Cubomedusae, as there an abundance of live material could be had, and for three months he worked indefatigably, making valuable experiments and observations, and writing enthusiastically to his friends at home of his success.

We know full well the noble and self-sacrificing devotion he showed in those dark days of suspense and sorrow which closed the expedition, and how bravely, unflinchingly and cheerfully he bore the sore burdens that fell upon him—bore them like the man he was, a true hero. He saw his duty clearly and followed it without fear, fully appreciating his own great danger but never faltering. He fell where he had always walked, in the path of duty and noble purpose and in his very death we have a lasting inspiration, an uplifting memory.

On the seventh of September he sailed from Port Antonio, Jamaica, but on the second day of the voyage was stricken with fever, and died in Boston on the thirteenth. He was buried at Wellesley Hills on his twenty-seventh birthday, September 21, 1897.

How can we put in words the priceless value of his manhood, the bright promise of his life and strength, the sincerity, the purity of his heart! To those who knew him it is superfluous; to those who knew him not it comes too late. The greatest tribute that can be paid him, the greatest comfort to those who knew and loved him, and mourn his irreparable loss, is that their lives are better, their aspirations higher by reason of the knowledge and the love. He is one of "The immortal dead who live again in minds made better by their presence."

As our memory brings him back, we shall ever recall with admiration and reverence his absolute honesty and integrity and sincerity, clothed in a high-mindedness that was truly matchless. He was generous, noble-hearted and pure, without a trace in his nature of selfishness or intolerance, showing only charity and kindliness to all. His indignation was never aroused except when he was stirred by some story of the injustice or oppression of others. The constant cheerfulness, the gentle merriment, and withal a perfect frankness, made his presence a delight to his friends, and no one who knew him could have failed to be deeply influenced by his strong, lovable personality. The loftiness and purity of his ideals, which were so beautifully exemplified in his own life and character, made him a man consecrated among his fellow-men to good and truth.

His modesty in things concerning himself and his attainments was most marked but perfectly genuine, and this underrating of his own ability was so simple and ingenuous that it gave him an additional charm and made the force of his mind and character impress one the more strongly. He was the possessor of a most unusual and indefatigable memory, and was continually drawing from his treasury things both old and new. We shall all remember the use he made of his apt quotations which never failed of force and beauty. It was to this retentive memory and a diligent study of the Bible that he owed a very thorough knowledge of the Scriptures; and friends have wondered if the strong and simple English style which has been so often praised and admired in his writing, had not been unconsciously imbibed from King James' version.

In this man of many sides the artistic part of his nature was very highly developed. He was extremely fond of music, both grave and gay, and always regretted that he was too busy to give more time to the study of his beloved violin, on which he was an excellent performer. He took great delight in literature, both prose and poetry appealing to him, though the latter rather the more strongly. He was a warm lover of Stevenson and Kipling among the moderns, and from youth up had deeply loved the poems of Whittier; of the classic poets Horace was perhaps his favorite.

The great natural force and purity of his well-trained and balanced mind, and his absolute, unfaltering devotion to the truth would have made him a power for good in the world, had his life been spared. He was as honest in intellectual things as in everything else, hating all deceit and sham, believing that men should use their strength and power to the fulness of their capacity in the cause of truth and honesty. He was willing to follow where Truth might lead him, giving all his faculties to the pursuit thereof and looking steadfastly to the goal beyond. He loved science for science's sake, and had the highest conception of its aim and beauty.

Although his death is inscrutable, incomprehensible to us, it was a noble death, for he died for the love of that truth which had been his guide through life. His loss can never be repaired for us, but he will still live in our hearts, and the good and purity, and nobility of his life and character will be ever an inspiration to us to attain to things higher and better, to forget self as he did, and live pure in heart and mind, with our faces set to the truth. The clear sense of obligation and duty he felt that every one owed to the world, which was to be faithfully served with the best and highest of one's powers, is so beautifully expressed in the closing words of his Valedictory address, when he bade farewell to his class at Williams College, that it will be like hearing him speak for himself to add it here. We know how that noble purpose was fulfilled in his life, and in reading in his own words, written four years ago, of his aspirations, his conception then of his duty, the following carries with it a prophetic force.

"The time has come for us to take leave of our Alma Mater. It is a season of mingled feelings, common to all at one period or another of life, to be experienced and not described. Glad are we, in the strength of our youth, that the time of preparation is over, and we are now to enter more widely into the activities of life. The past has been pleasant, the present is full of hope and vigor, and the future glowing with the light of our own eager anticipations. Yet even with us, like the monotone of an undercurrent that sometimes rises and asserts itself over all the rest, is the regret that the former things are to be no more. We know that the time will be measured, not by years, but by months only, when we should count it an inexpressible happiness to be able to return and live some of the old scenes over again.

"I would liken it all to that memorial window in yonder building, whose magic art on Sabbath evenings of the past term has translated the radiance of the low-declining sun into a hundred harmonies of color, kindling thoughts whose expression is beyond my power. The story of a life is there: the joy of existence, the hope, the enthusiasm of youth, the promised land of the future shining gloriously ahead, the angel portraying the harmony of things human and divine—and over it all, the dark clouds remind us that life has its sombre and tragic side as well.

"Let the lesson of the window be our farewell thought. May the loyalty to duty and the faithfulness in service, which it commemorates, be characteristic of the class which our College sends forth on this her centennial year. With enthusiasm enough to overcome the prevailing indifference of the times, and moderation sufficient to hold that enthusiasm well in poise, may we go out to render to the community the service that the nobility of education obliges. It may be little that we can do at best, but that little is demanded. My Class-mates, I bid you a hearty God-speed, when I say farewell."

LIST OF PUBLISHED BIOLOGICAL PAPERS.

1. Description of Two New Chaetognaths. Johns Hopkins University Circulars, No. 119, June, 1895.
2. Notes on the Chaetognaths. Johns Hopkins University Circulars, No. 126, June, 1896.
3. The Inhibitory and Accelerator Nerves to the Crab's Heart (*an abstract*), by F. S. Conant and H. L. Clark. Johns Hopkins University Circulars, No. 126, June, 1896.
4. On the Accelerator and Inhibitory Nerves to the Crab's Heart, by F. S. Conant and H. L. Clark. The Journal of Experimental Medicine, Vol. I, No. 2, 1896.
5. Notes on the Cubomedusae (*an abstract*). Johns Hopkins University Circulars, No. 132, November, 1897.
6. The Cubomedusae. (This was accepted in June, 1897, as his thesis for the degree of Doctor of Philosophy; and it is to be hoped that some way to publish it, with the illustrations which accompany it, may soon be found.)

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III.—A Descriptive and Critical Discussion of the Asexual and Sexual Development of Salpa.—Chapter IX. The Origin and Maturation of the Egg of Salpa. Chapter X. Sex in Salpa. Chapter XI. The Fertilization and Segmentation of the Egg. Chapter XII. The Accessory Parts of the Embryo. Chapter XIII. The Follicle and the Placenta. Chapter XIV. The Ontogeny of the Organs of Salpa.

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THE JOURNAL OF EXPERIMENTAL MEDICINE is devoted to original investigations in Physiology, Pathology, Bacteriology, Pharmacology, Physiological Chemistry, Hygiene and Medicine.

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The Journal has secured the support and scientific contributions of a large number of American collaborators, who are active workers in the departments represented.

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Volume Two (1897) is also just ready. It includes 750 pages, with 54 plates and 13 figures in text. It contains 50 separate papers from the scientific medical laboratories of America. The price of this volume is $5 (£1.1.0), either in cloth or in paper parts.

The first number of Vol. III (1898) will appear in January.

The contents of Volume Two, No. 6 (November, 1897), just ready, are as follows:

MEYER, ADOLF (from the Worcester Lunatic Hospital). Anatomical Findings in a Case of Facial Paralysis of Ten Days' Duration in a General Paralytic, with Remarks on the Termination of the 'Auditory' Nerves. (With two plates).

TAYLOR, EDWARD WYLLYS (from the Sears Pathological Laboratory of the Harvard Medical School). A Contribution to the Study of Human Neuroglia. (With four plates).

THOMAS, H M., and HAMILTON, ALICE (from the Pathological Laboratory of the Johns Hopkins University and Hospital). The Clinical Course and Pathological Histology of a Case of Neuro-Glioma of the Brain. (With four plates).

LE COUNT, E. R. (from the Pathological Laboratory of Rush Medical College). Focal or Insular Necrosis produced by the Bacillus of Tuberculosis. (With one plate).

OHLMACHER, A. P. (from the Pathological Laboratory of the Ohio Hospital for Epileptics). Technical Note. I. A Modified Fixing Fluid for General Histological and Neuro-Histological Purposes. II. A Staining Combination of Gentian Violet and Picro-Acid Fuchsin.

HISS, PHILIP HANSON, JR. (from the Bacterial Laboratory of the College of Physicians and Surgeons, and the Research Bacteriological Laboratory of the Health Department of New York City). On a Method of Isolating and Identifying Bacillus Typhosus, based on a Study of Bacillus Typhosus and Members of the Colon Group in Semi-Solid Culture Media.

MELTZER, S. J., and NORRIS, CHARLES (from the Physiological and Pathological Departments of the College of Physicians and Surgeons, Columbia College, New York). The Bactericidal Action of Lymph taken from the Thoracic Duct of the Dog.

HUNT, REID, and HARRINGTON, D. W. (from the Physiological Laboratory of Columbia University at the College of Physicians and Surgeons, New York). Notes on the Physiology of the Cardiac Nerves of the Opossum (Didelphys Virginiana).

HUNT, REID, and HARRINGTON, D. W. (from the Physiological Laboratory of Columbia University at the College of Physicians and Surgeons, New York). Note on the Physiology of the Cardiac Nerves of the Calf.

A list of papers contained in Volumes One and Two will be sent on application to D. Appleton & Co., N. Y., or to N. Murray, Johns Hopkins University, Baltimore, Maryland, to either of whom orders may also be sent.

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LIST OF SERIAL PUBLICATIONS.

I. American Journal of Mathematics.

This journal was commenced in 1878, under the editorial direction of Professor Sylvester. It is now conducted by Professor T. Craig as Editor, with the coöperation of Professor Simon Newcomb. Nineteen volumes of about 400 pages each have been issued, and the twentieth is in progress. It appears quarterly. Subscription $5 per year. Single numbers $1.50.

A very few complete sets remain. These will be sold for one hundred dollars per set.

II. American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as Editor. Nineteen volumes of about 450 pages each have been issued, and the twentieth is in progress. Ten numbers are issued yearly. Subscription $4 per year. Single numbers 50 cents.

III. American Journal of Philology.

The publication of this journal commenced in 1880, under the editorial direction of Professor Gildersleeve. Seventeen volumes of about 570 pages each have been issued, and the eighteenth is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1. Only a few sets remain in the hands of the editor.

IV. Studies from the Biological Laboratory.

The publication of these papers commenced in 1879, under the direction of Professor Martin, with the assistance of Professor W. K. Brooks. Four volumes of about 500 pages, octavo, and 40 plates each, have been issued.

V. Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Professor H. B. Adams. Fifteen series are now completed and the sixteenth series in progress. Sixteen extra volumes have also been issued. Subscription $3 per volume. A set, including the sixteen regular series and the sixteen extra volumes, will be sold for seventy dollars.

VI. Memoirs from the Biological Laboratory.

These monographs are issued under the editorial direction of Professor W. K. Brooks. Volume III was issued in 1894. Price for the set of three volumes twenty-five dollars. (See page 21).

VII. Johns Hopkins University Circulars.

The publication of these Circulars began in December, 1879, and 132 numbers have since been issued. Subscription $1.00 per year.

VIII. Contributions to Assyriology and Comparative Semitic Philology.

The publication of these papers was begun in 1889. Professor Paul Haupt, of the Johns Hopkins University, and Professor Friedrich Delitzsch, of the University of Breslau, are the editors. Volume III in progress.

IX. The Johns Hopkins Hospital Reports.

These reports are edited by the Faculty of the Johns Hopkins Medical School and published for the Johns Hopkins Hospital. Their publication was begun in 1890. Volume VII is in progress. Subscription $5 per volume. The set of seven volumes will be sold for thirty-five dollars.

X. The Johns Hopkins Hospital Bulletin.

The publication of these Bulletins began in 1889. Volume IX is in progress. They are published monthly. Subscription $1.00 per year. The set of nine volumes will be sold for fifteen dollars.

XI. Modern Language Notes.

This journal is edited by Professor A. M. Elliott and his associates in the Modern Language Department. It appears monthly. The twelfth volume is in progress. Subscription $1.50 per year.

XII. The Journal of Experimental Medicine.

This journal began publication in 1896. It is edited by Professor W. H. Welch with the coöperation of a number of associates. It appears six times yearly. Volume III is in progress. Subscription $5.00 per year. Price of set, twenty dollars. (See page 21).

XIII. American Journal of Insanity.

This journal is edited by Professor Henry M. Hurd and his associate editors. It appears quarterly. Subscription $5 per year.

XIV. Annual Report,

Presented by the President to the Board of Trustees, reviewing the operations of the University during the past academic year.

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Giving the list of the officers and students and containing detailed statements as to the regulations and work of the University.

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ENUMERATION OF CLASSES, FIRST HALF-YEAR, 1897-98.

Mathematics. (62 Students).

Classes meet in the Physical Laboratory, except as otherwise stated.

Advanced Theory of Functions: Professor CRAIG. Monday, Tuesday, and Thursday, 9 a. m., Room 26. (5).

Eiesland.
Hardy.
James, G. O.
Siff.
Stuart, T.

Theory of Surfaces: Professor CRAIG. Monday, Tuesday, and Thursday, 10 a. m., Room 26. (6).

Eiesland.
Hardy.
James, G. O.
McInnes.
Siff.
Stuart, T.

Mathematical Conference: Professor CRAIG. Friday, 9 a. m., Room 26. (6).

Eiesland.
Hardy.
James, G. O.
McInnes.
Siff.
Stuart, T.

Elementary Theory of Functions: Dr. CHESSIN. Monday and Tuesday, 11 a. m., Room 26. (7).

Eisenhart.
James, G. O.
Ortmann.
Rabinovitch.
Reese, H. M.
Siff.
Stuart, T.

Projective Geometry: Dr. CHESSIN. Thursday and Friday, 12 m., Room 26. (2).

Hardy.
Rabinovitch.

Theory of Invariants: Dr. COHEN. Wednesday, 8 a. m., Thursday and Friday, 11 a. m., Room 26. (4).

Eiesland.
Eisenhart.
Rabinovitch.
Siff.

Differential Equations: (*Undergraduate Elective*): Dr. COHEN. Tuesday and Thursday, 8 a. m., Room 27. (20).

Armstrong, J. R. C.
Beeuwkes, R. K.
Dorsey, H. G.
Earhart.
Edmunds.
Eisenhart.
Everett.
Fitzgerald.
Frank, E.
Lucke.
Martin.
Meyer.
Ortmann.
Pender.
Potts.
Rabinovitch.
Reese, H. M.
Siff.
Swaine.
Whitehead.

Determinants; Calculus (*Special Topics*): (*Major Course*): Dr. HULBURT. Daily, except Monday, 9 a. m., Room 27. (8).

Bestor.
Earhart.
Ford.
Haulenbeek.
Meyer.
Rabinovitch.
Routh.
Whitehead.

Analytic Geometry and Calculus: (*Minor Course*): Dr. HULBURT. Daily, except Friday, 1 p. m., Room 26. (26).

Altvater.
Baetjer, H.
Beale.
Beeuwkes, C. J.
Bird.
Brooks, C. E.
Byers.
Donaldson.
Douglas.
Flinn.
Ford.
Foster, F.
Foutz.
Francis, I. H.
Gminder.
Howard.
Hyde.
James, R.
Kerr.
King, T. H.
Liddell.
Mackall.
Powell.
Smith, W. L.
Turnbull.
Wirt.

Elementary Solid Geometry: Dr. COHEN. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., Thursday, 12 m., Room 7, McCoy Hall. (9).

Anderson.
Bernheim.
Constantine.
Diggs.
Homer.
Levering.
Morrison.
Snavely, G. E.
Stein, L. D.

Physics and Astronomy. (103 Students).

Classes meet in the Physical Laboratory.

Heat Conduction; Light: Professor ROWLAND. Daily, except Wednesday, 10 a. m. (8).

Harrison, C. N.
Mendenhall.
Penniman.
Rhoads.
Rothermel.
Saunders, F. A.
Schenck.
Waidner.

Physical Seminary: Dr. AMES. Saturday, 9 a. m. (12).

Bliss.
Dorsey, N. E.
Harrison, C. N.
Mather.
Mendenhall.
Mitchell.
Penniman.
Rhoads.
Rothermel.
Saunders, F. A.
Schenck.
Waidner.

Journal Meeting: Professor ROWLAND and Dr. AMES. Wednesday, 11 a. m. (24).

Bliss.
Dorsey, N. E.
Earhart.
Edmunds.
Harrison, C. N.
Huff.
James, G. O.
Jones, H. C.
Martin.
Mather.
Mendenhall.
Meyer.
Mitchell.
Ortmann.
Penniman.
Potts.
Reese, H. M.
Reid, H. F.
Rhoads.
Rothermel.
Saunders, F. A.
Schenck.
Waidner.
Whitehead.

Optical Theories: Dr. AMES. Thursday and Friday, 11 a. m. (20).

Earhart.
Edmunds.
Harrison, C. N.
Huff.
James, G. O.
Martin.
Mather.
Mendenhall.
Meyer, J. F.
Mitchell.
Ortmann.
Penniman.
Potts.
Reese, H. M.
Rhoads.
Rothermel.
Saunders, F. A.
Schenck.
Stuart, T.
Waidner.

Physics: (*Major Course*): Dr. AMES. Daily, except Thursday, 12 m. (24).

Armstrong, J. R. C.
Beale, R. B.
Bestor.
Earhart.
Eisenhart.
Fitzgerald.
Frank, E.
Ford.
Haulenbeek.
Horn.
Huff.
Judge.
Lucke.
Martin.
McInnes.
Meyer.
Ortmann.
Pender.
Potts.
Siff.
Smith, F. W.
Straus.
Whitten.
Young.

Physics: (*Minor Course*): Dr. AMES. Daily, except Tuesday, 10 a. m. (39).

Abercrombie.
Altvater.
Berkeley.
Blanchard.
Bouchelle.
Breed.
Bruce.
Case.
Donaldson.
Douglas.
Foutz.
Geraghty.
Glaser.
Greene, C. W.
Herrick.
Howard.
James, R.
L'Engle.
Liddell.
Mackall.
McAll.
Meisenhelder.
Morrison.
Remsen, C. M.
Robinson, G. C.
Rogers.
Rous.
Routh.
Russell.
Seth.
Simmons.
Smith, S. P.
Taneyhill.
Turnbull.
White.
Wight.
Williams, D.
Winslow.
Winston.

Applied Electricity: (*Second Year*): Dr. DUNCAN. Monday and Tuesday, 9 a. m., Room 24. (12).

Bartell.
Brady, W. B.
Edmunds.
Frank, E.
Gorsuch.
Haldeman.
Hodges, W. L.
Keidel, F. B.
Kershner.
Martin.
Ortmann.
Spencer.

Applied Electricity: (*First Year*): Dr. DUNCAN. Thursday and Friday, 9 a. m., Room 24. (13).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Brady, W. B.
Dorsey, H. G.
Edmunds.
Everett.
Frank, E.
Haldeman.
Judge.
Ortmann.
Stephens, J. C.
Swaine.

Electrical Measurements: Mr. HERING. Monday and Friday, 10 a. m., Room 27. (13).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Brady, W. B.
Dorsey, H. G.
Everett.
Frank, E.
Haldeman.
Judge.
Martin.
Ortmann.
Stephens, J. C.
Swaine.

Steam Engine: Mr. GEER. Wednesday, Thursday, and Friday, 11 a. m., Room 27. (7).

Bartell.
Gorsuch.
Haldeman.
Hodges, W. L.
Keidel, F. B.
Kershner.
Spencer.

Strength of Materials: Mr. GEER. Monday and Tuesday, 11 a. m., Room 27. (9).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Dorsey, H. G.
Everett.
Haulenbeek.
Judge.
Stephens, J. C.
Swaine.

Electrical Seminary: Dr. DUNCAN, Mr. HERING, Mr. GEER. Wednesday, 9 a. m. (17).

Armstrong, J. R. C.
Bartell.
Beale, R. B.
Beeuwkes, R. K.
Brady, W. B.
Dorsey, H. G.
Everett.
Frank, E.
Gorsuch.
Haldeman.
Hodges, W. L.
Judge.
Keidel, F. B.
Kershner.
Spencer.
Stephens, J. C.
Swaine.

Spherical and Practical Astronomy: Dr. POOR. Tuesday, 9 a. m., Wednesday, 10 a. m., Room 34. (4).

Eisenhart.
James, G. O.
McInnes.
Penniman.

Observatory Work: Dr. POOR and Dr. DORSEY. Daily, 8 p. m. (9).

Eiesland.
Eisenhart.
James, G. O.
McInnes.
Mendenhall.
Mitchell.
Penniman.
Saunders, F. A.
Stuart, T.

Descriptive Astronomy: (*Undergraduate Elective*): Dr. POOR. Monday, 9 a. m., Tuesday, 10 a. m., Room 34. (3).

Duffy.
Palmer, J. H.
Routh.

Celestial Mechanics: Dr. CHESSIN. Monday, Tuesday, and Wednesday, 12 m., Room 34. (2).

Mitchell.
Stuart, T.

Laboratory Work: Professor ROWLAND, Dr. DUNCAN, Dr. AMES, Mr. HERING, Mr. GEER, Dr. BLISS, Dr. DORSEY. Daily, 9 a. m. to 5 p. m. (91).

Abercrombie.
Altvater.
Armstrong, J. R. C.
Bartell.
Beale, R. B.
Beeuwkes, R. K.
Berkeley.
Bestor.
Blanchard.
Bouchelle.
Brady, W. B.
Breed.
Bruce.
Case.
Donaldson.
Dorsey, H. G.
Douglas.
Earhart.
Edmunds.
Eiesland.
Eisenhart.
Everett.
Fitzgerald.
Ford.
Foutz.
Frank, E.
Geraghty.
Glaser.
Gorsuch.
Greene, C. W.
Haldeman.
Harrison, C. N.
Haulenbeek.
Herrick.
Hodges, W. L.
Horn.
Howard.
Huff.
James, G. O.
James, R.
Judge.
Keidel, F. B.
Kershner.
L'Engle.
Liddell.
Lucke.
Mackall.
Martin.
McAll.
McInnes.
Meisenhelder.
Mendenhall.
Meyer.
Mitchell.
Morrison.
Ortmann.
Pender.
Penniman.
Potts.
Reese, H. M.
Remsen, C. M.
Rhoads.
Robinson, G. C.
Rogers.
Rothermel.
Rous.
Routh.
Saunders, F. A.
Schenck.
Seth.
Siff.
Simmons.
Smith, F. W.
Smith, S. P.
Spencer.
Stephens, J. C.
Strans.
Stuart, T.
Swaine.
Taneyhill.
Turnbull.
Ver Planck.
Waidner.
White.
Whitehead.
Whitten.
Wight.
Williams, D.
Winslow.
Winston.
Young.

Special Course in Physics for Medical Students: Dr. MATHER. Saturday, 9 a. m.–12 m. (7).

Baldwin.
Berry.
Bloombergh.
Drake.
Hume.
Lewis.
Ulrich.

Chemistry. (126 Students).

Classes meet in the Chemical Laboratory, unless otherwise stated.

Organic Chemistry: (*For Graduate Students*): Professor REMSEN. Monday and Tuesday, 9 a. m. (42).

Arbuckle.
Berkeley.
Bird.
Black.
Blanchard.
Byers.
Canter.
Case.
Caspari.
Chamberlain.
Cook, C. G.
Crane.
Douglas.
Fraps.
Hancock.
Holmes.
Horn.
Howard.
Humphreys.
Jones, W. A.
King, S. H.
Lawson.
Magruder.
Mattern.
Nakaseko.
Ota.
Patterson.
Potts.
Reid, E. E.
Russell.
Ryland.
Scott.
Simmons.
Smith, E. S.
Suppan.
Turner.
Washburn.
Waters.
Weedon.
Whitten.
Wilson, F. D.
Winston.

Journal Meeting: Professor REMSEN. Saturday, 9–10.30 a. m. (45). The instructors in Chemistry and the following students:

Arbuckle.
Berkeley.
Black.
Blanchard.
Byers.
Canter.
Case.
Caspari.
Chamberlain.
Cook, C. G.
Crane.
Douglas.
Fraps.
Holmes.
Horn.
Howard.
Humphreys.
Jones, W. A.
King, S. H.
Lawson.
Magruder.
Mattern.
Nakaseko.
Ota.
Reid, E. E.
Russell.
Ryland.
Scott.
Simmons.
Smith, E. S.
Suppan.
Turner.
Washburn.
Waters.
Weedon.
Whitten.
Wilson, F. D.
Winston.

Inorganic and Analytical Chemistry: (*For Graduate Studen* Professor MORSE. Friday, 9 a. m. (28).

Arbuckle.
Berkeley.
Black.
Blanchard.
Byers.
Canter.
Case.
Caspari.
Cook, C. G.
Crane.
Douglas.
Horn.
Howard.
Humphreys.
Jones, W. A.
King, S. H.
Mattern.
Ota.
Russell.
Ryland.
Scott.
Simmons.
Smith, E. S.
Turner.
Waters.
Weedon.
Whitten.
Wilson, F.

Physical Chemistry: Dr. RANDALL. Wednesday and Thurs 9 a. m. (21).

Ballard.
Black.
Blanchard.
Byers.
Canter.
Cook, C. G.
Douglas.
Fischer, J. S.
Hancock.
Horn.
Howard.
King, S. H.
Ota.
Potts.
Reese, H. M.
Russell.
Ryland.
Suppan.
Turner.
Weedon.
Whitten.

Special Course in Physical Chemistry: Dr. H. C. Jo Thursday and Friday, 12 m. (11).

Byers.
Caspari.
Hancock.
Howard.
King, S. H.
Ota.
Reese, H. M.
Suppan.
Waters.
Whitten.
Wilson, F.

Inorganic Chemistry: (*Major Course*): Professor RENOUF. Da except Monday, 9 a. m. (35).

Bouchelle.
Breed.
Bruce.
Cook, H. W.
Flinn.
Greenbaum.
Haskell.
Herrick.
Hirshberg.
Huff.
Jungbluth, M.
Keidel, A.
King, T. H.
Lazenby.
L'Engle.
Liddell.
Morgan.
Remsen, C. M.
Robinson, G. C.
Rogers.
Smith, R. M.
Smith, W.
Taveau.
Thomas, R.
Tobin.
Werber.
Williams, D
Wright, A.

In addition, the following graduate students attend the *lectures* of Major Course:

Bird.
Kershner.
Martin.
Patterson.
Rothermel.
Waidner.
Washburn.

General Chemistry: (*Minor Course*): Professor REMSEN, Dr. R DALL, Dr. GILPIN. Daily, except Monday, 9 a. m., Hopkins Hall.

Altvater.
Baetjer, H.
Brady, J. H.
Brent.
Brooks, C. E.
Cleaver.
Clunet.
Crummer.
Dieffenbach.
Donaldson.
Downes.
Fosnocht.
Foster, F.
Foutz.
French.
Gaddess.
Geraghty.
Glaser.
Gminder.
Gordon.
Grimes.
Hubner.
Hyde.
James, R.
Jones, T. D.
Jungbluth, K.
Levering.
McAll.
McIntosh.
Miller, R. D.
Mullen.
Murkland.
Powell.
Robinson, E. A.
Ross.
Rous.
Smith, F. W
Smith, S. P.
Smull.
Spilman.
Stein.
Stewart, W.
Taneyhill.
Ulman.
White.
Winslow.
Wirt.
Wright, H.

In addition, the following graduate students attend the *lectures* of Minor Course:

Berkeley.
Case.
Crane.
Fraps.
Jones, W. A.
Russell.
Simmons.
Waters.
Weedon.

Laboratory Work: Professor REMSEN, Professor MORSE, Profe RENOUF, Dr. RANDALL, Dr. GILPIN, Dr. H. C. JONES, Dr. RE Daily, 9 a. m. to 5 p. m. (124).

Arbuckle.
Altvater.
Baetjer, H.
Berkeley.
Bird.
Black.
Blanchard.
Bouchelle.
Brady, J. H.
Breed.
Brent.
Brooks, C. E.
Bruce.
Bruns.
Byers.
Canter.
Case.
Caspari.
Chamberlain.
Cleaver.
Clunet.
Cook, C. G.
Cook, H. W.
Crane.
Crummer.
Dieffenbach.
Donaldson.
Douglas.
Downes.
Fischer, J. S.
Flinn.
Fosnocht.
Foster, F.
Foutz.
Francis, I. H.
Fraps.
French.
Gaddess.
Geraghty.
Glaser.
Gminder.
Gordon.
Greenbaum.
Grimes.
Hancock.
Haskell.
Herrick.
Hirshberg.
Holmes.
Horn.
Howard.
Hubner.
Huff.
Humphreys.
Hyde.
James, R.
Jones, T. D.
Jones, W. A.
Jungbluth, K.
Jungbluth, M.
Keidel, A.
King, S. H.
King, T. H.
Lawson.
Lazenby.
L'Engle.
Levering.
Liddell.
Magruder.
Martin.
Mattern.
McAll.
McIntosh.
Miller, R. D.
Morgan.
Mullen.
Murkland.
Nakaseko.
Ota.
Patterson.
Potts.
Powell.
Reese, H. M.
Reid, E. E.
Remsen, C. M.
Robinson, E. A.
Robinson, G. C.
Rogers.
Ross.
Rous.
Russell.
Ryland.
Scott.
Simmons.
Smith, E. S.
Smith, F. W
Smith, R. M
Smith, S. P.
Smith, W.
Smull.
Spilman.
Stein.
Stewart, W.
Suppan.
Surface.
Taneyhill.
Taveau.
Thomas, R.
Tobin.
Turner.
Ulman.
Washburn.
Waters.
Weedon.
Werber.
White.
Whitten.
Williams, D
Wilson, F.
Winslow.
Winston.
Wirt.
Wright, A.
Wright, H.

Geology. (37 Students).

Classes meet in the Geological Laboratory.

General Geology: Professor CLARK and Dr. SHATTUCK. Lectu daily, except Friday, 12 m.; laboratory work, Wednesday, 2–5 p. excursions, Saturdays. (15).

Canter.
Cleaver.
Coker.
Fischer, J. S.
Fraps.
Hall, C. M.
Lehr.
Robinson, G. C.
Rowe.
Stein.
Surface.
Taveau.
Thomas, R.
Turner.
Williams, D

Physiographic Geology: Mr. GILBERT. Daily, except Friday, 4 p. m., January 1 to February 15. (11).

Abbe. Canter. Cleaver. Coker. Glenn. Hall, C. M. Hartzell. Leonard. McLaughlin. Rowe. Surface.

Historical Geology: Professor CLARK. Tuesday and Wednesday, 9 a. m. (10).

Abbe. Dorsey, C. W. Glenn. Hall, C. M. Hartzell. Leonard. McLaughlin. Reese, A. M. Rowe. Surface.

Paleontology: (*Laboratory Work*): Professor CLARK and Dr. SHATTUCK. Daily, 9 a. m. to 5 p. m. (10).

Abbe. Cleaver. Glenn. Hall, C. M. Hartzell. Leonard. McLaughlin. Reese, A. M. Rowe. Surface.

Geological Physics: Dr. REID. Friday, 11 a. m., after January 1. (7)

Abbe. Dorsey, C. W. Hartzell. Glenn. Leonard. McLaughlin. O'Harra.

Geological Physics: (*Laboratory Work*): Dr. REID. Daily, 9 a. m. to 5 p. m. (4).

Abbe. Glenn. Leonard. McLaughlin.

Petrography: Dr. MATHEWS. Thursday, 9 a. m., Friday, 11 a. m. (8).

Abbe. Glenn. Hall, C. M. Hartzell. Leonard. McLaughlin. Rowe. Surface.

Petrography: (*Laboratory Work*): Dr. MATHEWS. Daily, 9 a. m. to 5 p. m. (9).

Abbe. Cleaver. Glenn. Hall, C. M. Hartzell. Leonard. McLaughlin. Rowe. Surface.

Mineralogy: Dr. MATHEWS. Lectures, daily, except Friday, 11 a. m.; laboratory work, Monday, 2–5 p. m.; excursions, Saturdays. (18).

Black. Caspari. Cleaver. Glenn. Hall, C. M. Hancock. Hartzell. Holmes. Humphreys. Leonard. McLaughlin. Patterson. Rowe. Scott. Surface. Washburn. Weedon. Wilson, F. D.

Climatology: Mr. FASSIG. Monday and Thursday, 9 a. m. [12 lectures]. (19).

Abbe. Cronk. Dorsey, C. W. Easton. Gilpin. Glenn. Hall, C. M. Hartzell. Howe. Jewell. Leonard. Mathews. McLaughlin. O'Harra. Rowe. Saunders, F. A. Shattuck. Surface. Walz.

Map Drawing: Mr. GEER. Afternoons, Front Building, Room 9. (7).

Cleaver. Hall, C. M. Hartzell. Leonard. McLaughlin. Rowe. Surface.

Journal Club: Professor CLARK, Dr. REID, Dr. MATHEWS. Friday, 9 a. m. [After January 1, Saturday, 9 a. m]. (13).

Abbe. Bibbins. Cleaver. Dorsey, C. W. Fassig. Glenn. Hall, C. M. Hartzell. Leonard. McLaughlin. Rowe. Shattuck. Surface.

Biology. (92 Students.)

Classes meet in the Biological Laboratory.

Advanced Zoology: Professor BROOKS. Daily, 10 a. m. to 5 p. m. (6).

Berger. Drew. Grave. Lamb. Lefevre. Reese, A. M.

Zoological Journal Club: Professor BROOKS and Dr. ANDREWS. Friday, 11 a. m. (15).

Barton. Berger. Coker. Drew. Grave. Greene, C. W. Harrison, R. G. Howe. Johnson, D. S. Knower. Lamb. Lefevre. Metcalf. Reese, A. M. Sudler.

Zoology: (*Major Course*): Professor BROOKS. Daily, except Monday, 9 a. m.; Monday and Tuesday, 2–5 p. m. (7).

Chambers. Coker. Dohme. Howe. Renouf, V. A. Scholl. Wooldridge.

Zoology: (*Undergraduate Elective*): Professor BROOKS. Tuesday, 2–5 p. m. (4).

Ferguson. Lehr. Myers, S. B. VerPlanck.

Physiological Seminary: Professor HOWELL. Tuesday, 4 p. m. (4).

Dreyer. Greene, C. W. Herrick. Walden.

Physiological Journal Club: Professor HOWELL. Monday, 4 p. m. (4).

Dreyer. Greene, C. W. Herrick. Walden.

Animal Physiology: Professor HOWELL. Wednesday, Thursday, and Friday, 12 m. (46).

Graduate Students.

Crane. Howe. Herrick. Norris, R. S. Walden.

Medical Students.

Akerman. Allen. Austin. Beale, A. E. Bettman. Brülle. Burman. Chace. Chittenden. Christian. Dancy. Eggers. Evans, H. C. Fairbank. Farrar. Fisher, A. L. Fisher, W. A. Fletcher. Flint. Healy. Hendrickson. Hewlett. Kellogg. Kyes. Lewis. Little, H. W. MacCallum. Marvell. Meltzer. Myrick. Odell. Rand. Reed, D. M. Rusk. Sabin. Sowers. Stone, E. A. Thayer, L. H. Warren, M. West, J. M. Woolley.

Osteology: (*Minor Course*): Dr. ANDREWS. Monday and Wednesday, 10 a. m. (30).

Abbe. Anderson. Ballard. Browne, B. B. Burrell. Canter. Cator. Coker. Duffy. Francis, W. W. Hirshberg. Howe. Jungbluth, M. Lazenby. L'Engle. Mattern. Meisenhelder. Miller, F. O. Nakaseko. Palmer, E. L. Purcell. Reese, A. M. Rogers. Rowe. Smith, R. M. Stein, L. D. Sudler. Thomas, R. H. Tobin. Williams, D.

General Biology: (*Minor Course*): Dr. ANDREWS. Thursday and Friday, 10 a. m., 2–5 p. m. (30).

Abbe. Anderson. Ballard. Browne, B. B. Burrell. Canter. Cator. Coker. Duffy. Francis, W. W. Hirshberg. Howe. Jungbluth, M. Lazenby. L'Engle. Mattern. Meisenhelder. Miller, F. O. Nakaseko. Palmer, E. L. Purcell. Rogers. Rowe. Smith, R. M. Stein, L. D. Sudler. Thomas, R. H. Tobin. Washburn. Williams, D.

Laboratory Work: Professor BROOKS, Professor HOWELL, Dr. ANDREWS, Dr. DREYER, Dr. LEFEVRE. Daily, 9 a. m.–5 p. m. (90).

Abbe. Akerman. Allen. Anderson. Austin. Ballard. Beale, A. E. Berger. Bettman. Browne, B. B. Brülle. Burnam. Burrell. Canter. Cator. Chace. Chambers. Chittenden. Christian. Coker. Crane. Dancy. Dohme. Drew. Duffy. Eggers. Evans, H. C. Fairbank. Farrar. Ferguson. Fisher, A. L. Fisher, W. A. Fletcher. Flint. Francis, W. W. Grave. Greene, C. W. Healy. Hendrickson. Herrick. Hewlett. Hirshberg. Howe. Johnson, D. S. Jungbluth, M. Kellogg. Kyes. Lamb. Lazenby. Lehr. L'Engle. Lewis. Little, H. W. McCallum. Marvell. Mattern. Meisenhelder. Meltzer. Miller, F. O. Myers, S. B. Myrick. Nakaseko. Norris, R. S. Odell. Palmer, E. L. Purcell. Rand. Reed, D. M. Reese, A. M. Renouf, V. A. Bogers. Rowe. Rusk. Sabin. Scholl. Smith, R. M. Sowers. Stein, L. D. Stone, E. A. Sudler. Thayer, L. H. Thomas, R. H. Tobin. Ver Planck. Walden. Warren, M. West, J. M. Williams, D. Wooldridge. Woolley.

Greek. (45 Students).

Classes meet in McCoy Hall.

Greek Seminary: *Plato:* Professor GILDERSLEEVE. Monday and Wednesday, 10 a. m., Room 14. (17).

Burgess. Eckels. Foster, H. B. Foushee. Hamilton. Hullihen. Kern. Kingsbury. Little, C. H. Milden. Montgomery. Penick. Sanders, H. N. Savage. Schulz. Spragins. Warner.

Introduction to Plato: Professor GILDERSLEEVE. Thursday, 10 a. m., Room 14. (24).

Basore. Burgess. Eckels. Foster, H. B. Foushee. Gill. Green, E. L. Hamilton. Hullihen. Jones, T. M. Kern. Kingsbury. Land. Little, C. H. Maguire. Milden. Montgomery. Ness. Penick. Sanders, H. N. Savage. Schulz. Spragins. Warner.

Practical Exercises: Professor GILDERSLEEVE. Tuesday and Friday, 10 a. m., Room 14. (17).

Burgess. Eckels. Foster, H. B. Foushee. Hamilton. Hullihen. Kern. Kingsbury. Little, C. H. Milden. Montgomery. Penick. Sanders, H. N. Savage. Schulz. Spragins. Warner.

Plato's Republic: Dr. MILLER. Tuesday and Thursday, 9 a. m., Room 15. (15).

Burgess. Eckels. Foster, H. B. Foushee. Hamilton. Kern. Kingsbury. Milden. Montgomery. Penick. Sanders, H. N. Savage. Schulz. Spragins. Warner.

Demosthenes, 54, 55; ***Dion Chrysostom,*** *The Hunters of Euboea:* (*Undergraduate Elective*): Dr. SPIEKER. Thursday, 12 m., Friday, 1 p. m., Room 12. (2).

Harry, P. W. Pyle.

Plato, Phaedo: (*Major Course*): Dr. SPIEKER. Monday, Tuesday, Wednesday, 12 m., Room 10. (6).

Bogue.
Fisher, F. C.
French.
King, J. H.
Ross.
Spilman.

Andocides, de Mysteriis: (*Minor Course*): Dr. SPIEKER. Tuesday, Wednesday, Thursday, 1 p. m., Room 10. (10).

Anderson.
Burrell.
Chambers.
Eager.
Ewell.
Griffin, J. W.
Purcell.
Ramsay.
Shriver.
Wight.

Homer; Herodotus; Prose Composition: Dr. MILLER. Monday, 10 a. m.; Thursday and Friday, 1 p. m., Room 8. (3).

Bernheim.
Constantine.
Snavely, G. E.

Prose Composition: Dr. SPIEKER.

Major Course: Friday, 12 m., Room 10. (7).

Bogue.
Fisher, F. C.
French.
King, J. H.
Montgomery.
Ross.
Spilman.

Minor Course: Monday, 1 p. m., Room 10. (10).

Anderson.
Burrell.
Chambers.
Eager.
Ewell.
Griffin, J. W.
Purcell.
Ramsay.
Shriver.
Wight.

Latin. (71 Students).

Classes meet in McCoy Hall.

Latin Seminary: *Plautus and Terence:* Professor WARREN. Tuesday and Friday, 11 a. m., Room 15. (20).

Basore.
Burgess.
Daniel.
Foster, H. B.
Foushee.
Gill.
Glascock.
Hamilton.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Lyon.
Maguire.
Milden.
Sanders, H. N.
Savage.
Schulz.
Spragins.
Warner.

Roman Comedy: Professor WARREN. Monday, 11 a. m., Room 15. (23).

Basore.
Burgess.
Daniel.
Eckels.
Foster, H. B.
Foushee.
Gill.
Glascock.
Hamilton.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Lyon.
Maguire.
Milden.
Ness.
Penick.
Sanders, H. N.
Savage.
Schulz.
Spragins.
Warner.

Latin Inscriptions: Professor WARREN. Thursday, 11 a. m., Room 15. (21).

Basore.
Burgess.
Daniel.
Foster, H. B.
Foushee.
Gill.
Glascock.
Green, E. L.
Hamilton.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Lyon.
Maguire.
Milden.
Sanders, H. N.
Schulz.
Spragins.
Warner.
Wilson, H. L.

Aulus Gellius: Professor WARREN. Wednesday, 11 a. m., Room 15. (18).

Basore.
Burgess.
Daniel.
Foster, H. B.
Foushee.
Gill.
Hamilton.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Lyon.
Maguire.
Milden.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Journal Club: Professor WARREN. . Alternate Thursdays, 12 m., Room 15. (15).

Basore.
Burgess.
Daniel.
Foushee.
Gill.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Maguire.
Milden.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Pro-Seminary: Dr. SMITH. Monday, 9 a. m., Room 15. (7).

Burgess.
Foster, H. B.
Little, C. H.
Lyon.
Schulz.
Spragins.
Warner.

Juvenal: (*Major Course*): Dr. SMITH. Wednesday, Thursday, and Friday, 10 a. m., Room 10. (14).

Bogue.
Chambers.
Davidson.
Fisher, F. C.
French.
Gemmill.
Greene, J. D.
Jones, R. H.
Kalb, J. A.
King, J. H.
Ramsay.
Ross.
Smith, V. E.
Spilman.

Roman Literature: (*Minor Course*): Dr. SMITH. Tuesday, 9 a. m., Room 11. (15).

Beeuwkes, C. J.
De Grange.
Francis, W. W.
Heyman.
Hill, H. D.
Hill, J. P.
Kaufman, H.
Lindheim.
Loeb.
Marshall, T. H.
Moore, J. S.
Peters.
Schermerhorn.
Stephens, C. G.
Wingert.

Livy: (*Minor Course*): Dr. WILSON. Wednesday, Thursday, Friday, 9 a. m., Room 12. (24).

Anderson.
Beeuwkes, C. J.
Burrell.
Clark, C. T.
De Grange.
Eager.
Ewell.
Francis, W. W.
Griffin, J. W.
Heyman.
Hill, H. D.
Hill, J. P.
Kaufman, H.
Lindheim.
Loeb.
Marshall, T. H.
Moore, J. S.
Peters.
Purcell.
Roulston.
Schermerhorn.
Stephens, C. G.
Wight.
Wingert.

Cicero; Sallust; Prose Composition: Dr. WILSON. Wednesday, Thursday, Friday, 10 a. m., Room 8. (9).

Bernheim.
Brady, J. H.
Constantine.
Crummer.
Diggs.
Ember.
Flinn.
Snavely, G. E.
Whitman.

Prose Composition:

Major Course: Dr. SMITH. Monday, 10 a. m., Room 10. (14).

Bogue.
Chambers.
Davidson.
Fisher, F. C.
French.
Gemmill.
Greene, J. D.
Jones, R. H.
Kalb, J. A.
King, J. H.
Ramsay.
Ross.
Smith, V. E.
Spilman.

Minor Course: Dr. WILSON. Tuesday, 9 a. m., Room 12. (9).

Anderson.
Burrell.
Clark, C. T.
Eager.
Ewell.
Griffin, J. W.
Purcell.
Roulston.
Wight.

Sanskrit and Comparative Philology. (40 S dents).

Classes meet in Room 19, McCoy Hall.

Comparative Philology: (*Lectures on the Ethnology of the In European Peoples*): Professor BLOOMFIELD. Monday, 4 p. m. (17).

Barnett.
Brush.
Campbell.
Drewry.
Eiesland.
Foster, H. B.
Frank, S. W.
Greenbaum.
Harry, P. W.
Hodges, C. S.
Jones, R. H.
Jones, T. M.
Miller, A. D.
Nitze.
Pyle.
Radcliffe.
Smith, V. E.

Comparative Grammar of the Indo-European La guages: (*Noun-Formation*): Professor BLOOMFIELD. Thursd 4 p. m. (18).

Basore.
Blake.
Burgess.
Eckels.
Foushee.
Green, E. L.
Grimm.
Hamilton.
Jones, T. M.
Kern.
Kingsbury.
Kurrelmeyer, W.
Land.
Maguire.
Milden.
Montgomery.
Ness.
Penick.

Lithuanian Language and Literature: Professor BLOO FIELD. Tuesday, 4 p. m. (5).

Blake.
Bolling.
Green, E. L.
Kurrelmeyer, W.
Ness.

Vedic Seminary: (*Brāhmaṇas and Upaniṣads*): Professor BLOO FIELD. Friday, 4 p. m. (9).

Basore.
Blake.
Foushee.
Green, E. L.
Hamilton.
Kern.
Milden.
Ness.
Sanders, H.

Introduction to the Language of the Avesta: Mr. NE Thursday, 3 p. m. (2).

Blake.
Grimm.

Advanced Sanskrit: (*Hitopadeça and Manu*): Professor BLOO FIELD. Wednesday, 12 m. (8).

Basore.
Blake.
Foushee.
Hamilton.
Kern.
Milden.
Sanders, H.
Savage.

Elementary Sanskrit: Professor BLOOMFIELD. Monday and F day, 12 m. (7).

Foster, H. B.
Grimm.
Huguenin.
Kurrelmeyer, W.
Maguire.
Schulz.
Spragins.

Oriental Seminary. (55 Students).

Classes meet in the Dillmann Library, McCoy Hall, Room 18, unl otherwise stated.

Critical Interpretation of Selected Chapters of the Autho ized Version: (*The Early Narratives of Genesis*): Professor HAU Wednesday, 5 p. m., McCoy Hall, Room 24. (42).

Abbe.
Ballard.
Barr.
Becker.
Butler.
Caldwell.
Campbell, K.
Cantey.
Edmunds.
Fassig.
Glenn.
Griffin, N. E.
Grimm.
Guttmacher.
Hagen.
Hall, C. M.
Heald.
Howard.
Huguenin.
Jewell.
Kaufman, H.
Kurrelmeyer.
Land.
Lee.
Leonard.
McPherson.
Miller, R. D.
Motley.
Ness.
Norris, R. S.
O'Harra.
Paine.
Parham.
Rothermel.
Rowe.
Ryland.
Sommerville.
Stearns.
Sumwalt.
West, H. S.
Wharey.
Wingert.

Elementary Hebrew: (*Gesenius-Mitchell's Hebrew Grammar; Gene ed. Baer-Delitzsch*): Professor HAUPT. Wednesday, 3–5 p. m. (5).

Frank, S. W.
Gardner.
Grimm.
Heald.
McPherson.

Hebrew: (*Second Year's Course: Interpretation of the Book of Judges* Professor HAUPT. Monday, 4 p. m. (13).

Blake.
Caldwell.
Grimm.
Guttmacher.
Land.
Mahoney.
McPherson.
Rosenau.
Schanfarber.
Stearns.
Sumwalt.
Tracy.
Weaver, E. E

Hebrew Exercises: (*Cursory Reading of the Book of Isaiah*): I JOHNSTON. Thursday, 9–11 a. m. (3).

Grimm.
Mahoney.
Tracy.

Exercises in Reading Hebrew at Sight: (*Historical Books* Dr. JOHNSTON. Friday, 12 m. (5).

Blake.
Caldwell.
McPherson.
Sumwalt.
Weaver, E. E

Hebrew Prose Composition: (*Translating from English into Hebrew*): Professor HAUPT. Monday, 3.30 p. m. (12).

Blake.
Caldwell.
Grimm.
Guttmacher.
Land.
Mahoney.
McPherson.
Rosenau.
Schanfarber.
Sumwalt.
Tracy.
Weaver, E. E.

Comparative Hebrew Grammar: Professor HAUPT. Tuesday, 3 p. m. (10).

Blake.
Caldwell.
Grimm.
Guttmacher.
Land.
McPherson.
Rosenau.
Schanfarber.
Sumwalt.
Weaver, E. E.

Hebrew: (*Advanced Course: Critical Interpretation of the Book of Isaiah, Chapters i–xxxix*): Professor HAUPT. Monday, 5 p. m. (13).

Caldwell.
Cantey.
Grimm.
Guttmacher.
Land.
Mahoney.
McPherson.
Rosenau.
Schanfarber.
Sommerville.
Sumwalt.
Tracy.
Weaver, E. E.

Critical Interpretation of the Aramaic Portions of the Books of Daniel and Ezra: Professor HAUPT. Tuesday, 4 p. m. (9).

Caldwell.
Grimm.
Guttmacher.
Land.
McPherson.
Rosenau.
Schanfarber.
Sumwalt.
Weaver, E. E.

Syriac: (*Roediger's Chrestomathy*): Dr. JOHNSTON. Friday, 11 a. m. (3).

Grimm.
Land.
Sumwalt.

Arabic for Beginners: (*Socin's Grammar*): Dr. JOHNSTON. Wednesday, 10 a. m. (2).

McPherson.
Sumwalt.

Selections from the Arabian Nights: Dr. JOHNSTON. Tuesday, 9–11 a. m. (5).

Grimm.
Guttmacher.
Land.
Rosenau.
Schanfarber.

Arabic Prose Composition: (*Translating from English into Arabic*): Professor HAUPT. Monday, 3 p. m. (7).

Blake.
Grimm.
Guttmacher.
Land.
Rosenau.
Schanfarber.
Sumwalt.

Assyrian for Beginners: (*Meissner's Chrestomathy*): Dr. JOHNSTON. Wednesday, 11 a. m. (2).

McPherson.
Sumwalt.

Assyrian Historical Texts: Dr. JOHNSTON. Tuesday, 11 a. m. (2).

Grimm.
Land.

Sumerian: (*Bilingual Incantations*): Professor HAUPT. Tuesday, 5 p. m. (2).

Grimm.
Land.

History of Assyria and Babylonia: Dr. JOHNSTON. Friday, 10 a. m. (13).

Benton.
Caldwell.
Cantey.
Grimm.
Kaye.
Land.
Lee.
McPherson.
Paine.
Schmeckebier.
Sloussat.
Sumwalt.
Weaver, C. C.

German. (116 Students).

Classes meet in McCoy Hall.

(*Advanced Courses.*)

German Seminary: *Goethe's Lyrical Poems:* Professor WOOD. Tuesday, Thursday, and Friday, 9 a. m., Room 4. (10).

Blake.
Brown, G. D.
Farr.
Glascock.
Hofmann.
Hullihen.
Kurrelmeyer, W.
Little, C. H.
Lyon.
Wharey.

Germanic Society: Professor WOOD. Fortnightly, Friday, 8 p. m. (18).

Becker.
Blake.
Brown, G. D.
Campbell, K.
Farr.
Glascock.
Hagen.
Heald.
Hofmann.
Hullihen.
Jones, T. M.
Kurrelmeyer, W.
Little, C. H.
Lyon.
Ness.
Nitze.
Wharey.
Wilkens.

Gothic: Professor WOOD. Wednesday and Friday, 10 a. m., Room 4. (8).

Blake.
Eiesland.
Glascock.
Hagen.
Heald.
Lyon.
Parham.
West, H. S.

Old Saxon: *Heliand:* Professor WOOD. Tuesday and Friday, 11 a. m., Room 3. (5).

Becker.
Campbell, K.
Hofmann.
Kurrelmeyer, W.
Ness.

Schiller's Dramas: Professor WOOD. Wednesday, 9 a. m., Room 4. (9).

Glascock.
Hofmann.
Hullihen.
Kurrelmeyer, W.
Little, C. H.
Lyon.
Miles.
Nitze.
Wharey.

Middle High German: Dr. VOS. Monday and Tuesday, 1 p. m., Room 8. (7).

Blake.
Eiesland.
Farr.
Glascock.
Hagen.
Heald.
Lyon.

Modern Dutch: Dr. VOS. Monday and Wednesday, 11 a. m., Room 6. (3).

Blake.
Hofmann.
Kurrelmeyer, W.

The German Novel in the XVIII and XIX Centuries: Dr. BAKER. Tuesday and Friday, 12 m., Room 12. (3).

Becker.
Jones, T. M.
Little, C. H.

(*Major Course.*)

Scherer, *History of German Literature:* Dr. VOS. Monday. ***Lessing,*** *Nathan der Weise:* Dr. VOS. Wednesday and Friday. ***Prose Composition:*** Professor WOOD and Dr. BAKER. Thursday, 10 a. m., Room 6. (7).

Baetjer, H.
Farr.
Haskell.
Keidel, A.
Miles.
Powell.
Smull.

(*Minor Course A.*)

Prose Composition: Professor WOOD. Monday. ***Prose Readings and Classics:*** Dr. VOS. Tuesday, Thursday, and Friday, 11 a. m., Room 11. (27).

Bouchelle.
Breed.
Eager.
Ember.
Flinn.
Foster, F.
De Grange.
Greene, J. D.
Heyman.
Hill, H. D.
Hill, J. P.
Hyde, E. P.
King, T. H.
Lazenby.
Loeb.
Mackall.
Peters.
Roulston.
Rous.
Routh.
Schermerhorn.
Smith, W. L.
Stephens, C. G.
Tobin.
Turnbull.
White.
Winslow.

(*Minor Course B.*)

Dr. BAKER. Daily, except Wednesday, 11 a. m., Room 8. (22).

Brooks, C. E.
Clark, C. T.
Ewell.
Fisher, F. C.
Ford.
Francis, I. H.
Geraghty.
Griffin, J. W.
Kaufman, H.
Kerr.
Lindheim.
Marshall, T. H.
McAll.
Moore, J. S.
Motley.
Murkland.
Rogers.
Shriver.
Smith, S. P.
Wingert.
Wirt.
Wright, H. C.

Elementary German: (*Thomas's Practical German Grammar*): Dr. VOS. Tuesday, Wednesday, and Friday, 9 a. m., Room 6. (7).

Abercrombie.
Bernheim.
Constantine.
Diggs.
Morrison.
Snavely, G. E.
Whitman.

German Conversation: Dr. HOFMANN. Tuesday, 5 p. m., Room 8. (13).

Davidson.
Duffy.
Farr.
Fosnocht.
Francis, W. W.
Frank, S. W.
Greenbaum.
Hagen.
Hall, C. M.
Meisenhelder.
Miles.
Siff.
Williams, D.

(*Elective Courses.*)

Contemporary Readings: Dr. BAKER. Monday, 9 a. m., Tuesday, 10 a. m., Room 8. (16).

Browne, B. B.
Clunet.
Cook, H. W.
Dieffenbach.
Fischer, J. S.
Fosnocht.
Francis, W. W.
Frank, S. W.
Gordon.
Greenbaum.
Hammond.
Hodges, C. S.
Kalb, C. W.
Smith, F. M.
Smith, R. M.
Stidman.

Scientific Readings: Dr. BAKER. Thursday, 12 m., Friday, 1 p. m., Room 6. (5).

Dohme.
Hirshberg.
Kershner.
Scholl.
Straus.

Scientific German: (*For Graduate Students*): Dr. HOFMANN. Monday and Thursday, 5 p. m., Room 8. (10).

Hall, C. M.
Howe.
Meisenhelder.
Pender.
Potts.
Reese, H. M.
Rowe.
Siff.
Walden.
Williams, D.

English. (131 Students).

Classes meet in McCoy Hall.

English Seminary: (*The poetry of Cynewulf and of his period*): Professor BRIGHT. Tuesday and Thursday, 3–5 p. m., Room 4. (12).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Hagen.
Heald.
Huguenin.
Parham.
West, H. S.
Wharey.

English Versification: (*Lectures*): Professor BRIGHT. Wednesday, 4 p. m., Thursday, 12 m. (13).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Hagen.
Heald.
Huguenin.
Miles.
Parham.
West, H. S.
Wharey.

Plays of Shakespeare: Professor BRIGHT. Tuesday, 12 m., Room 12. (13).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Hagen.
Heald.
Huguenin.
Miles.
Parham.
West, H. S.
Wharey.

Journal Meeting: Professor BRIGHT. Alternate Fridays, 8–10 p. m. Room 4. (14).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Hagen.
Heald.
Huguenin.
Miles.
Parham.
Shipley.
West, H. S.
Wharey.

Anglo-Saxon: (*Major Course*): Professor BRIGHT. Monday and Wednesday, 12 m., Room 8. (4).

Browne, B. B.
Jones, A. D.
Miles.
Stidman.

The English Drama from Dryden to Sheridan: (*Lectures*): Professor BROWNE. Wednesday, 11 a. m., Room 8. (12).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Heald.
Huguenin.
Miles.
Parham.
West, H. S.
Wharey.

Elizabethan Literature; Early Scottish Poets: (*Major Course*): Professor BROWNE. Tuesday and Friday, 12 m., Room 8. (3).

Browne, B. B.
Jones, A. D.
Stidman.

Early English Texts; English Literature: (*Minor Course*): Professor BROWNE. Daily, except Friday, 1 p. m., Room 6. (14).

Ballard.
Cator.
Clunet.
Duffy.
Greenbaum.
Hanna.
Harry, P. W.
Harwood.
Hill, H. D.
Hubner.
Lazenby.
Murkland.
Peters.
Smith, V. E.

English Literature: (*Undergraduate Elective*): Professor GREENE. Thursday, 12 m., Friday, 1 p. m., Room 9. (9).

Ballard.
Browne, B. B.
Hammond.
Jones, R. H.
Miller, F. O.
Palmer, J. H.
Ramsay.
Renouf, V. E.
Seth.

English Literature: (*Required Undergraduate Course*): Professor GREENE. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., Room 11. (40).

Bogue.
Brady, J. H.
Bruce.
Chambers.
Crummer.
Downes.
Fisher, F. C.
Fooks.
French.
Gaddess.
Gemmill.
Grimes.
Guggenheimer.
Hanna.
Haskell.
Jones, T. D.
Joyner.
Jungbluth, K.
Jungbluth, M.
Kalb, J. A.
Keidel, A.
King, J. H.
Knapp.
Krager.
Lazenby.
Morgan.
Mullen.
Ramsay.
Remsen, C. M.
Reymann.
Robinson, G. C.
Ross.
Smull.
Spilman.
Talty.
Taveau.
Thomas, R. H.
Verplanck.
Werber.
Whitman.

Rhetoric and English Composition: Professor GREENE. Monday, Tuesday, Wednesday, 12 m., Room 11. (58).

Abercrombie.
Altvater.
Anderson.
Baetjer, H.
Beeuwkes, C. J.
Bernheim.
Bouchelle.
Brady, J. H.
Breed.
Brooks, C. E.
Burrell.
Clark, C. T.
Constantine.
De Grange.
Diggs.
Donaldson.
Eager.
Ewell.
Foster, F.
Foutz.
Francis, I. H.
Glaser.
Gminder.
Greene, J. D.
Griffin, J. W.
Heyman.
Hill, H. D.
Hill, J. P.
Hyde.
James, R.
Kaufman, H.
Kerr.
King, T. H.
Liddell.
Lindheim.
Loeb.
Mackall.
Marshall, T. H.
McAll.
Moore, J. S.
Morrison.
Powell.
Purcell.
Roulston.
Rous.
Routh.
Schermerhorn.
Shriver.
Smith, S. P.
Smith, W. L.
Stephens, C. G.
Taneyhill.
White.
Wight.
Wingert.
Winslow.
Wirt.
Wright, H. C.

Romance Languages. (77 Students).

Classes meet in McCoy Hall.

(*Advanced Courses.*)

Romance Seminary: *Fables of Marie de France:* Professor ELLIOTT. Tuesday, 11 a. m.–1 p. m., Room 2. (8).

Baxter.
Brownell, G. G.
Brush.
Frein.
Kuersteiner.
Nitze.
Shaw.
Wilson, R. H.

French Dialects: Professor ELLIOTT. Monday, 11 a. m., Room 2. (6).

Baxter.
Frein.
Holden.
Kuersteiner.
Shaw.
Wilson, R. H.

French Philology: Dr. ARMSTRONG. Monday, 10 a. m., Wednesday, 9 a. m., Friday, 11 a. m., Room 2. (8).

Brush.
Frein.
Hagen.
Holden.
Kuersteiner.
Nitze.
Parham.
Teillard.

French Physiological Phonetics: Dr. ARMSTRONG. Tuesday, 10 a. m., Room 2. (8).

Farr.
Glascock.
Hagen.
Lyon.
Nitze.
Parham.
Teillard.
Wharey.

Old French Readings: Dr. ARMSTRONG. Monday and Wednesday, 3 p. m., Room 2. (8).

Brush.
Farr.
Glascock.
Hagen.
Lyon.
Parham.
Shaw.
Wharey.

French Criticism: Dr. OGDEN. Thursday, 12 m., Room 2. (7).

Brownell, G. G.
Frein.
Glascock.
Kuersteiner.
Lyon.
Nitze.
Shaw.

Historical French Syntax: Mr. R. H. WILSON. Monday and Tuesday, 9 a. m., Room 2. (7).

Armstrong, E. C.
Brush.
Frein.
Nitze.
Ogden.
Shaw.
Teillard.

Popular Latin: Professor ELLIOTT. Monday, 12 m.; Room 2. (6).

Brush.
Frein.
Holden.
Kuersteiner.
Shaw.
Wilson, R. H.

Dante: Professor ELLIOTT. Wednesday, 12 m., Room 2. (2).

Kuersteiner.
Wilson, R. H.

Spanish Seminary: Dr. MARDEN. Thursday, 10 a. m., Room 2. (2

Brownell, G. G.
Kuersteiner.

Spanish Epic Poetry: Dr. MARDEN. Friday, 12 m., Room 2. (3

Brownell, G. G.
Kuersteiner.
Shaw.

Old Spanish Readings: Dr. MARDEN. Monday, 10 a. m., Room (3).

Brownell, G. G.
Holden.
Kuersteiner.

Spanish Philology: Dr. MARDEN. Wednesday and Friday, 10 a. n Room 2. (2).

Brownell, G. G.
Kuersteiner.

Romance Club: Professor ELLIOTT. Wednesday, 11 a. m., Room (12).

Armstrong, E. C.
Baxter.
Brownell, G. G.
Brush.
Frein.
Kuersteiner.
Keidel, G. C.
Marden.
Nitze.
Ogden.
Shaw.
Wilson, R. H.

Methodology of the Romance Languages: Dr. KEIDEL. This course begins January 1, 1898.

(*Undergraduate Courses.*)

Italian: (*Minor Course*): Dr. RAMBEAU. Daily, except Monda 9 a. m., Room 7. (3).

Clarke, G. M.
Jones, A. D.
Kurrelmeyer, H.

Italian: (*Undergraduate Elective*): Mr. BAXTER. Monday, 9 a. n Thursday, 12 m., Room 6. (3).

Fitzgerald.
Jones, R. H.
Stearns.

Spanish: (*Minor Course*): Dr. MARDEN. Daily, except Monda 9 a. m., Room 8. (5).

Davidson.
Guggenheimer.
Joyner.
Krager.
Reymann.

Spanish: (*Undergraduate Elective*): Mr. KUERSTEINER. Monda 9 a. m., Thursday, 12 m., Room 4. (1).

Clarke, G. M.

French: (*Major Course*): Dr. RAMBEAU. Daily, except Tuesda 10 a. m., Room 7. (8).

Dohme.
Grimes.
Morgan.
Mullen.
Palmer, J. H.
Siff.
Stidman.
Wharey.

French: (*Minor Course A*): Dr. RAMBEAU. Daily, except Thursda 12 m., Room 7. (19).

Crummer.
Davidson.
Ember.
Fosnocht.
Frank, S. W.
Hagen.
Harry, P. W.
Harwood.
Jones, R. H.
Jones, T. D.
Kalb, J. A.
Keidel, A.
Kurrelmeyer, H.
Miller, R. D.
Smull.
Tobin.
Werber.
Whitman.
Wright, H. C.

French: (*Minor Course B*): Dr. OGDEN. Daily, except Thursda 12 m., Room 6. (15).

Benton.
Bruce.
Fooks.
Gorsuch.
Hodges, C. S.
Knapp.
Pyle.
Ramsay.
Remsen, C. M.
Smith, V. E.
Snavely, C.
Stearns.
Stephens, J. C.
Walden.
Weaver, C. C.

French: (*Undergraduate Elective*): Dr. ARMSTRONG. Monday, 9 a. m Room 10; Friday, 1 p. m., Room 2. (11).

Bestor.
Brent.
Fowler, L. H.
Kennard.
Lehr.
Little, C. H.
McIntosh.
Miles.
Robinson, E. A.
Stewart, W. P.
Turnbull.

French: (*Elements*): Mr. KUERSTEINER. Tuesday, Thursday, an Friday, 9 a. m., Room 10. (3).

Greene, J. D.
Homer.
Meisenhelder.

History, Economics, and Politics. (124 Students).

Classes meet in McCoy Hall.

Historical Seminary: Professor ADAMS. Fortnightly, Frida 8–10 p. m., Room 25. (24).

Adams, T. S.
Barnett.
Benton.
Brough.
Campbell, H.
Cantey.
Drewry.
Ewing.
Garrett, R.
Jones, F. R.
Kaye.
Latané.
Lee.
Motley.
Myers, W. S.
Paine.
Radcliffe.
Schmeckebier.
Sioussat.
Smith, E. A.
Snavely, C.
Sommerville.
Thom.
Weaver, C. C.

History of Civilization: (*Major Course*): Professor ADAMS. Mo day and Tuesday, 11 a. m., Room 24. (40).

Barnett.
Bogue.
Campbell, H.
Davidson.
Downes.
Drewry.
Ensor.
Fooks.
Forney.
Frank, S. W.
Gaddess.
Gemmill.
Glaser.
Green, E. L.
Grimes.
Guggenheimer.
Hanna.
Harwood.
Haskell.
Jones, T. D.
Joyner.
Jungbluth, K.
Kalb, J. A.
Knapp.
Krager.
Kurrelmeyer, H.
Levering.
Morgan.
Mullen.
Myers, W. S.
Norris, H. C.
Paine.
Rayner.
Reymann.
Rickey.
Taneyhill.
Taylor.
West, H. S.
Willms.
Wright, A.

Roman Politics: Professor ADAMS. Wednesday and Thursday, 11 a. m., Room 25. (22).

Barnett.
Benton.
Campbell, H.
Cantey.
Dennis.
Drewry.
Ewing.
Garrett, J. W.
Garrett, R.
Green, E. L.
Kaye.
Lee.
Motley.
Myers, W. S.
Radcliffe.
Schloegel.
Schmeckebier.
Sioussat.
Snavely, C.
Sommerville.
Thom.
Weaver, C. C.

Nineteenth Century: Professor ADAMS. Friday, 11 a. m., Room 25. (24).

Barnett.
Benton.
Caldwell.
Campbell, H.
Cantey.
Dennis.
Drewry.
Ensor.
Ewing.
Garrett, R.
Green, E. L.
Kaye.
Lee.
Motley.
Myers, W. S.
Paine.
Radcliffe.
Schmeckebier.
Sioussat.
Snavely, C.
Sommerville.
Thom.
Weaver, C. C.
West, H. S.

Historical Method: Dr. VINCENT. Tuesday and Thursday, 10 a. m., Room 23. (18).

Adams. T. S.
Barnett.
Benton.
Campbell, H.
Cantey.
Dennis.
Drewry.
Ewing.
Kaye.
Motley.
Radcliffe.
Schloegel.
Schmeckebier.
Sioussat.
Snavely, C.
Sommerville.
Thom.
Weaver, C. C.

Historical Conference: Dr. VINCENT. Fortnightly, Saturday, 8–10 p. m. (9).

Adams, T. S.
Benton.
Kaye.
Motley.
Schmeckebier.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

European History: (*Major Course*)***:*** Dr. VINCENT. Thursday and Friday, 11 a. m., Room 24. (30).

Bogue.
Davidson.
Downes.
Fooks.
Frank, S. W.
Gaddess.
Gemmill.
Glaser.
Grimes.
Guggenheimer.
Hanna.
Harwood.
Haskell.
Jones, T. D.
Joyner.
Jungbluth, K.
Kalb, J. A.
Knapp.
Krager.
Kuersteiner.
Kurrelmeyer, H.
Levering.
Morgan.
Mullen.
Norris, H. C.
Rayner.
Reymann.
Rickey.
Taneyhill.
Wright, A.

Historical Politics: (*History-Economics*)***:*** Dr. VINCENT. Monday and Wednesday, 10 a. m., Room 23. (25).

Bestor.
Clunet.
Ferguson.
Fischer, J. S.
Fosnocht.
Fowler, L. H.
Greenbaum.
Harry, P. W.
Hodges, C. S.
Homer.
Kurrelmeyer, H.
Lucke.
Murkland.
Myers, S. B.
Pender.
Pyle.
Renouf, V. A.
Scholl.
Straus.
Taveau.
Ver Planck.
Werber.
Wooldridge.
Wright, A.
Young.

Municipal Government: Dr. BALLAGH. Thursday, 12 m., Room 20. (7).

Adams, T. S.
Cantey.
Schloegel.
Schmeckebier.
Sioussat.
Sommerville.
Weaver, C. C.

General History Examinations: Dr. BALLAGH. Tuesday, 9 a. m., Room 20. (3).

Kaye.
Lee.
Sommerville.

Greek and Roman History: (*Minor Course*)***:*** Dr. BALLAGH. Daily, except Tuesday, 10 a. m., Room 20. (15).

Beeuwkes, C. J.
Clark, C. T.
De Grange.
Heyman.
Hill, J. P.
Lindheim.
Loeb.
Marshall, T. H.
Moore, J. S.
Peters.
Roulston.
Schermerhorn.
Shriver.
Stephens, C. G.
Wingert.

Economic Seminary: Dr. SHERWOOD and Dr. HOLLANDER. Thursday, 4–6 p. m., Room 21. (7).

Adams, T. S.
Barnett.
Brough.
Campbell, H.
Radcliffe.
Schloegel.
Smith, E. A.

Modern Banking: Dr. SHERWOOD. Thursday and Friday, 9 a. m., Room 24. (18).

Adams, T. S.
Barnett.
Benton.
Brough.
Campbell, H.
Cantey.
Drewry.
Garrett, R.
Motley.
Myers, W. S.
Paine.
Radcliffe.
Schloegel.
Schmeckebier.
Sioussat.
Smith, E. A.
Snavely, C.
Sommerville.

Economic Sociology: Dr. SHERWOOD. Monday, 9 a. m., Room 24. (13).

Adams, T. S.
Barnett.
Brough.
Campbell, H.
Cantey.
Drewry.
Kaye.
Motley.
Paine.
Radcliffe.
Schmeckebier.
Smith, E. A.
Sommerville.

Interpretation of Ricardo: Dr. HOLLANDER. Tuesday and Wednesday, 9 a. m., Room 24. (8).

Adams, T. S.
Barnett.
Benton.
Brough.
Campbell, H.
Radcliffe.
Schloegel.
Smith, E. A.

Recent Economic Changes: (*Undergraduate Elective*)***:*** Dr. HOLLANDER. Thursday, 12 m., Friday, 1 p. m., Room 21. (8).

Drewry.
Garrett, R.
Myers, S. B.
Myers, W. S.
Morgan.
Schloegel.
Taylor.
Ulman.

History of Economics: Dr. HOLLANDER. Monday and Wednesday, 10 a. m., Room 24. (22).

Cook, H. W.
Dieffenbach.
Downes.
Fooks.
Frank, S. W.
Gaddess.
Guggenheimer.
Hammond.
Hanna.
Jones, T. D.
Joyner.
Jungbluth, K.
Kaufman, H.
Kennard.
Knapp.
Krager.
Levering.
Reymann.
Rickey.
Stearns.
Talty.
Willms.

Elements of Economics: Dr. SHERWOOD. Thursday and Friday, 10 a. m., Room 24. (53).

Bestor.
Clunet.
Cook, H. W.
Dieffenbach.
Dohme.
Downes.
Ferguson.
Fischer, J. S.
Fitzgerald.
Fooks.
Forney.
Fosnocht.
Fowler, L. H.
Frank, S. W.
Gaddess.
Greenbaum.
Guggenheimer.
Hammond.
Hanna.
Harry, P. W.
Harwood.
Hines.
Hodges, C. S.
Homer.
Jones, T. D.
Joyner.
Jungbluth, K.
Kaufman, H.
Kennard.
Knapp.
Krager.
Kurrelmeyer, H.
Lehr.
Levering.
Lucke.
Miller, R. D.
Murkland.
Norris, H. C.
Pender.
Pyle.
Rayner.
Renouf.
Reymann.
Rickey.
Scholl.
Stearns.
Straus.
Talty.
Taveau.
Werber.
Wooldridge.
Wright, A.
Young.

American Public Law: Dr. WILLOUGHBY. Monday and Tuesday, 11 a. m., Room 20. (13).

Adams, T. S.
Benton.
Cantey.
Ewing.
Kaye.
Lee.
Radcliffe.
Schloegel.
Schmeckebier.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

History of Political Philosophy: Dr. WILLOUGHBY. Monday and Tuesday, 12 m., Room 20. (15).

Barnett.
Campbell, H.
Cantey.
Drewry.
Ensor.
Ewing.
Garrett, J. W.
Garrett, R.
Kaye.
Myers, W. S.
Paine.
Schloegel.
Sioussat.
Sommerville.
Thom.

Political Conference: Dr. WILLOUGHBY. Fortnightly, Friday, 4–6 p. m., Room 20. (7).

Adams, T. S.
Kaye.
Schmeckebier.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

American Political and Constitutional History: Dr. STEINER. Wednesday and Friday, 12 m., Room 24. (27).

Brent.
Clarke, G. M.
Dieffenbach.
Ferguson.
Fowler, L. H.
Garrett, R.
Gemmill.
Gordon.
Hammond.
Hubner.
Kalb, C. W.
Kennard.
McIntosh.
Miller, F. O.
Motley.
Myers, S. B.
Myers, W. S.
Palmer, E. L.
Palmer, J. H.
Rickey.
Robinson, E. A.
Seth.
Sommerville.
Stewart, W. P.
Thom.
Ulman.
Willms.

English Constitutional Law and History: Mr. LEE. Monday and Tuesday, 12 m., Room 20. (24).

Brent.
Clarke, G. M.
Dieffenbach.
Ferguson.
Fowler, L. H.
Gemmill.
Gordon.
Hammond.
Hubner.
Kalb, C. W.
Kennard.
McIntosh.
Miller, F O.
Myers, S. B.
Palmer, E. L.
Palmer, J. H.
Payne.
Rickey.
Robinson, E. A.
Seth.
Stewart, W. P.
Talty.
Ulman.
Willms.

Philosophy. (59 Students).

Classes meet in Room 12, McCoy Hall.

History of Philosophy: Professor GRIFFIN. Friday, 3 p. m. (9).

Cator.
Ewing.
Guttmacher.
Motley.
Osmond.
Paine.
Rosenau.
Schanfarber.
Smith, E. A.

Deductive and Inductive Logic: until December 24: ***Psychology:*** January 1 to April 1; ***Ethics:*** after April 1: Professor GRIFFIN. Daily, 11 a. m. ***Outlines of the History of Philosophy:*** Weekly. (50).

Ballard.
Bestor.
Brent.
Browne, B. B.
Cator.
Clarke, G. M.
Cook, H. W.
Dieffenbach.
Dohme.
Duffy.
Ferguson.
Fischer, J. S.
Fitzgerald.
Fowler, L. H.
Francis, W. W.
Gordon.
Hammond.
Harry, P. W.
Hirshberg.
Hodges, C. S.
Hubner.
Jones, A. D.
Jones, R. H.
Kalb, C. W.
Kennard.
Lehr.
Lucke.
McIntosh.
Miller, F. O.
Miller, R. D.
Myers, S. B.
Osmond.
Palmer, J. H.
Pender.
Pyle.
Renouf, V. A.
Robinson, E. A.
Scholl.
Seth.
Smith, F. W.
Smith, R. M.
Smith, V. E.
Stearns.
Stewart, W. P.
Stidman.
Straus.
Ulman.
Whitehead.
Wooldridge.
Young.

Drawing. (79 Students).

Classes meet in the Howard Street building, Rooms 9 and 18.

Freehand Drawing: Mr. WHITEMAN. Tuesday and Thursday, 2–5 p. m. (62).

Abercrombie.
Altvater.
Anderson.
Baetjer, H.
Beeuwkes, C. J.
Bernheim, B. M.
Brady, J. H.
Brooks, C. E.
Burrell.
Clark, C. T.
Constantine.
Crummer.
De Grange.
Diggs.
Donaldson.
Eager.
Ember.
Ewell.
Flinn.
Foster, F.
Foutz.
Francis, I. H.
Glaser.
Gminder.
Greene, J. D.
Griffin, J. W.
Heyman.
Hill, H. D.
Hill, J. P.
Homer.
Hyde.
James, R.
Kerr.
Liddell.
Lindheim.
Loeb.
Mackall.
Marshall, T. H.
McAll.
Moore, J. S.
Morrison.
Powell.
Purcell.
Ramsay.
Ross.
Roulston.
Rous.
Schermerhorn.
Shriver.
Smith, S. P.
Snavely, G. E.
Stein, L. D.
Taneyhill.
Turnbull.
Ver Planck.
White.
Whitman.
Wight.
Wingert.
Winslow.
Wirt.
Wright, H. C.

Mechanical Drawing: Mr. Geer. Monday and Tuesday, 2–5 p. m. (17).

Armstrong, J. R. C.
Bartell.
Beale, R. B.
Beeuwkes, R. K.
Dorsey, H. G.
Edmunds.
Everett.
Gorsuch.
Haldeman.
Haulenbeek.
Hodges, W. L.
Keidel, F. B.
Kershner.
Pender.
Spencer.
Stephens, J. C.
Swaine.

Forensics and Elocution. (178 Students).

Classes meet in McCoy Hall.

Forensics: *Third Year* (*Senate*): Mr. Lee. Alternate Wednesdays, 11 a. m., Donovan Room. (52).

Ballard.
Bestor.
Brent.
Browne, B. B.
Clarke, G. M.
Clunet.
Cook, H. W.
Dieffenbach.
Dohme.
Duffy.
Ferguson.
Fischer, J. S.
Fitzgerald.
Fowler, L. H.
Francis, W. W.
Gordon.
Hammond.
Harry, P. W.
Harwood.
Hirshberg.
Hodges, C. S.
Hubner.
Jones, A. D.
Jones, R. H.
Kalb, C. W.
Kennard.
Lehr.
Lucke.
McIntosh.
Miller, F. O.
Miller, R. D.
Myers, S. B.
Osmond.
Palmer, J. H.
Pender.
Pyle.
Rayner.
Renouf, V. A.
Robinson, E. A.
Scholl.
Seth.
Smith, F. W.
Smith, R. M.
Smith, V. E.
Stearns.
Stewart, W. P.
Stidman.
Straus.
Ulman.
Whitehead.
Wooldridge.
Young.

Forensics: *Second Year* (*House of Representatives*): Mr. Lee. Alternate Wednesdays, 11 a. m., Donovan Room. (51).

Armstrong, J. R. C.
Bogue.
Bruce.
Chambers.
Davidson.
Downes.
Fisher, F. C.
Fooks.
Fosnocht.
Frank, S. W.
French.
Gaddess.
Gemmill.
Greenbaum.
Greene, J. D.
Grimes.
Guggenheimer.
Hanna.
Haskell.
Jones, T. D.
Joyner.
Jungbluth, K.
Jungbluth, M.
Kalb, J. A.
Kaufman, H.
Keidel, A.
King, J. H.
Knapp.
Krager.
Kurrelmeyer, H.
Lazenby.
Levering.
Morgan.
Mullen.
Murkland.
Palmer, E. L.
Ramsay.
Remsen, C. M.
Reymann.
Robinson, G. C.
Ross.
Smull.
Spilman.
Talty.
Taneyhill.
Taveau.
Thomas, R. H.
Tobin.
Ver Planck.
Werber.
Wright, A.

Elocution: *First Year:* Mr. Lee. Assembly Room.

Section I. Monday, 9 a. m. (18).

Abercrombie.
Adams, T. S.
Altvater.
Baetjer, H.
Beeuwkes, C. J.
Ewell.
Francis, I. H.
Glaser.
Greene, J. D.
Heyman.
Kerr.
Lindheim.
Loeb.
Ramsay, R. L.
Rous.
Smith, S. P.
Ulman.
Wingert.

Section II. Tuesday, 10 a. m. (18).

Clark, C. T.
Flinn.
Gminder.
King, J. H.
Liddell.
Marshall, T. H.
McAll.
Moore, J. S.
Powell.
Rickey.
Schermerhorn.
Seth.
Taneyhill.
Turnbull.
White.
Whitehead.
Wight.
Wright, H. C.

Section III. Thursday, 12 m. (20).

Bouchelle.
Brady, J. H.
Breed.
Burrell.
Donaldson.
Foster, F.
Foutz.
Gaddess.
Gardner.
Griffin, J. W.
Jones, T. D.
King, T. H.
Mackall.
Morrison.
Roulston.
Shriver.
Smith, W. L.
Ver Planck.
Whitman.
Winslow.

Section IV. Friday, 1 p. m. (19).

Anderson.
Brooks, C. E.
Crummer.
De Grange.
Diggs.
Eager.
Ember.
Fischer, J. S.
Grimes.
Hill, H. D.
Hill, J. P.
Hyde.
Purcell.
Ross.
Routh.
Sioussat.
Smith, V. E.
Wirt.
Wright, A.

STUDENTS IN THE JOHNS HOPKINS MEDICAL SCHOO

Candidates for the Degree of M. D.

Fourth Year. (26).

Baer, W. S.
Calvert, W. J.
Cassidy, P. J.
Coe, J. W.
Cox, W.
Dawson, P. M.
Elting, A. W.
Ford, W. W.
Hastings, T. W.
Herrick, A. B.
Johnstone, M. M. S.
Knox, J. H. M., Jr.
Langfeld, M.
Light, G. U.
Lupton, F. A.
Madison, J. D.
Marshall, H. T.
O'Connell, D. M.
Perkins, R. G.
Porter, K.
Pratt, J. H.
Sands, G.
Schenck, B.
Steiner, W.
Walker, E.
Whitridge,

Third Year. (34).

Brown, L.
Brownell, E. E.
Buckler, H. W.
Cole, R. I.
Davis, F. C.
Davis, J. S.
Emerson, C. P.
Epler, B. N.
Erlanger, J.
Evans, P. S., Jr.
Follis, R. H., Jr.
Fulton, F. T.
Gallagher, J. D.
Harris, H.
Hoye, H. J.
Ladd, L. W.
Little, C. S.
Luetscher, J. A.
Lynch, F. W.
Magee, C. L.
Moore, H. M.
Oliver, E. S.
Ottley, C. W.
Owsley, P. O.
Pleasants, J. H., Jr.
Rosenheim, S.
Sampson,
Steensland
Stone, W.
Strobel, E.
Verhoeff,
Williams,
Wyckoff,
Yates, L.

Second Year. (44).

Akerman, J.
Allen, H. W.
Austin, M. F.
Beale, A. E.
Bettman, M.
Briggs, E.
Brülle, H.
Burnam, C. F.
Chase, E. S.
Chittenden, A. S.
Christian, H. A.
Dancy, W. R.
Eggers, A. H.
Evans, H. C.
Fairbank, R.
Farrar, C. B.
Fisher, A. L.
Fisher, W. A., Jr.
Fletcher, H.
Flint, J. M.
Healy, W. P.
Hendrickson, W. F.
Hewlett, A. W.
Kellogg, W. C.
Kyes, P.
Lewis, W. H.
Little, H. W.
Lowell, E. L.
MacCallum, J. B.
Marvell, M. W.
Meltzer, C. R.
Mosher, C. D.
Myrick, H. G.
Odell, A.
Rand, R.
Reed, D.
Rusk, G.
Sabin, F.
Sowers,
Stone, E.
Thayer,
Warren,
West, J.
Woolley

First Year. (63).

Adler, H. M.
Atherton, A. M.
Baetjer, F. H.
Baldwin, W. D.
Berry, J. M.
Bloombergh, H. D.
Bosley, J. R.
Bunting, C. H.
Butler, J. I.
Carey, H. W.
Chowning, W. M.
Comer, R. T.
Comstock, E.
Connor, G. L.
Connor, R.
Drake, G. S., Jr.
Dutcher, A.
Fowler, H. A.
Gay, F. P.
Ghio, J. B.
Graham, N. D.
Hall, G. W.
Hamman, L. V.
Hastreiter, R. F.
Hathaway, J. H.
Hitzrot, J. M.
Holden, G. R.
Hume, E. H.
Johnston, W. B.
Kauffman, B. B.
Kaufman, H. M.
Kimball, A. H.
Lamson, T.
Lewis, D. M.
Long, M.
Longcope, W. T.
Lyle, A. G
Maddren, W. H.
Manwaring, W. H.
McKeough, E. P.
Moore, E. S.
Parker, H. P.
Pullen, F. K.
Rubel, M. J.
Rushmore, S.
Russ, R. J.
Salter, J. C.
Simis, M. P.
Slemons
Smith,
Spratt,
Stein, G.
Steinfel
Swett, C.
Ulrich, H.
Underhill,
Walker, M.
Warfield, L.
Warren, G.
Watts, S. H.
Wells, E. A.
Wells, M.
Winne, C. K., J

Physicians attending Special Courses. (9).

Behle, A. C.
Carpenter, F. A.
Cone, C.
Currie, W. L.
Fearn, T.
Latimer, C. W.
McCalla, L. P.
Nesbitt, B.
Wyeth, M. C.

During the months of May and June, 1897, the Special Courses f Graduates in Medicine were attended by 58 physicians. Their names a given in the first edition of the Annual Register, 1897–98, now ready.

THE JOHNS HOPKINS UNIVERSITY.

AUTUMN ENROLMENT.

		Nov. 12, 1896.		Nov. 15, 1897.
Philosophical Department:				
Graduates, - - - - - -		206		208
Undergraduates, - - - -		144		153
Special, - - - - - -		32		33
		382		394
Medical Department:				
Candidates for M. D.:				
Fourth year. - - -	17		26	
Third year, - - - -	29		34	
Second year, - - -	36		44	
First year, - - - -	42	124	63	167
Doctors of Medicine, - -		8		9
Total, - - - -		514		570

The above enumeration does not include all the attendants on special courses of instruction given to Doctors of Medicine.

Vacancies in the Hopkins Scholarships offered to graduate studen from North Carolina and Virginia have been filled as follows:

Honorary:

W. Hullihen, of Virginia.

Ordinary:

H. Canter, of Virginia.
W. C. Coker, of North Caroli

The Ordinary Hopkins Scholarships offered to newly-entering matric lated students from Maryland have been awarded, after a competiti examination, as follows:

J. W. Griffin.
J. H. Eager, Jr.
E. P. Hyde.
C. J. Beeuwkes.
F. P. Rous.
C. E. Brooks.

A course of twelve lectures by Professor W. K. Brooks on the Prin ples of Science as illustrated by Zoology began November 29, and w continue till December 15.

A course of laboratory work in Botany will be offered during the win term of the present year. Those interested may obtain further particul from D. S. Johnson, Ph. D., Adam T. Bruce Fellow, Room 16, Biologi Laboratory.

LECTURES OPEN TO THE PUBLIC DURING THE SESSION OF 1897-98.

[The Trustees of the Johns Hopkins University, in a desire to extend as far as they can the influence of the foundation, have decided to open to the public, during the current year, as heretofore, certain courses of lectures. It must be remembered that these are academic lectures, primarily intended for the instruction of students, and that they are supplementary to courses which are here in progress. Seats are therefore reserved for members of the University, who are usually so occupied that they cannot take their places until the last moment. Other hearers, understanding this regulation, are required to respect it by leaving the reserved seats free until the lecture hour. In most cases, cards of admission will not be needed. If there is likely to be a crowded room, tickets of admission will be issued, and these must be obtained in advance and shown at the door. Further particulars will be made known from time to time.]

I.

In connection with the classes in the history of Eastern Asia, lectures have been given on certain aspects of Modern Japan.

David Murray, Ph. D., LL. D., of New Brunswick, N. J., late Adviser to the Japanese Minister of Education, gave two lectures on Education in Japan, November 15 and 16.

Professor K. Mitsukuri, Ph. D., one of the Japanese Delegates to the recent Washington Conference on the Seal Fisheries, a graduate and formerly a Fellow of this University, gave two lectures on the University of Tokyo and on Recent Changes in Japan, November 17 and 18.

Mr. Rokuro Nakaseko, a graduate student of the University, gave an illustrated lecture on Contemporary Japan, November 19.

II.

The seventh course of Turnbull memorial lectures upon Poetry will be delivered in the latter part of March by Professor Charles R. Lanman, Ph.D., once a Fellow and an Associate of this University, and now Professor of Sanskrit in Harvard University. He has been for several years Secretary of the American Oriental Society, and is one of the most distinguished students of Sanskrit literature in this or any country.

The subject will be "The Poetry of India," and it will be treated in eight lectures, from March 21 to April 1.

III.

Provision is made from the income of the Donovan foundation, for several courses on English literature.

1. Mr. Richard Burton, of Hartford, Conn., a Doctor of Philosophy of this University, well known as a writer of poetry and prose, will deliver a course of six lectures on "The Modern Novel," from January 3 to 13.

2. Professor William Knight, LL. D., of the University of St. Andrews, the biographer of Wordsworth, and editor of the latest and most complete edition of the writings of that poet, will deliver three lectures on Wordsworth and his contemporaries, Coleridge, Shelley and Keats. This course will be given March 9, 10, 11.

3. Rev. Henry Van Dyke, D. D., LL. D., of New York, the well-known preacher and poet, will give three lectures March 15, 17, 18. His subject will be "Three Nineteenth Century Poets and Prophets,—Wordsworth, Browning, and Tennyson."

4. Professor Woodrow Wilson, of Princeton University, an alumnus and for many years a lecturer in this institution, has been invited to deliver several biographical lectures on certain recognized leaders of political science.

IV.

Rev. Professor T. K. Cheyne, D. D., of Oxford University, Oriel Professor of the Interpretation of Holy Scripture, and Canon of Rochester, will deliver six lectures on "Phases of Jewish Religious Life after the Exile," from January 4 to January 21.

This course has been arranged through the American Committee for Lectures on the History of Religions, organized in 1892 for the purpose of encouraging the intelligent study of religions. Professor Cheyne is one of the leading Biblical scholars of the day. Among his works are Studies of the Psalms; the Prophecies of Isaiah, Jeremiah, etc.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

October 21, 1897.—Annual business meeting. Officers for the ensuing year were electe as follows:

President, Professor IRA REMSEN; *Vice-President*, Professor WILLIAM H. HOWEL *Secretary*, Dr. CHARLES L. POOR.

November 23.—One hundred and thirty-fourth regular meeting. The following com munication was presented:

The Yerkes Observatory and the Exercises held in connection with its Dedicatio by CHARLES L. POOR.

Philological Association.

October 15, 1897.—One hundred and sixtieth regular meeting. Professor Gildersleev in the chair. Forty-eight members were present.

Papers read:

The Participle in Hesiod, by G. M. BOLLING.

November 19.—One hundred and sixty-first regular meeting. Professor Gildersleeve i the chair. Thirty-one members were present.

Papers read:

The Sources of Davenant's "Albovine" and "Siege of Rhodes," by K. CAMPBEL

The Arrangement of the Fables of Marie de France, by M. P. BRUSH.

Historical and Political Science Association.

October 8, 1897.

Local Observations in England and Scotland, by F. R. JONES.

Summer Studies in France and Switzerland, by J. M. VINCENT.

A Vacation in Berlin, by SIDNEY SHERWOOD.

— Materials for Southern History in State Libraries, by J. C. BALLAGH.

October 22.

An Oxford Summer Meeting, by F. R. JONES.

The Last Work of Herbert Tuttle, by L. F. SCHMECKEBIER.

The House of Arundel, by ST. G. L. SIOUSSAT.

Greater New York and its Street Railways, by T. S. ADAMS.

The Scholar and the State, by J. R. EWING.

November 5.

Memorial Sketch of Justin Winsor, by H. B. ADAMS.

An Edinburgh Summer Meeting, by H. B. ADAMS.

The Gold Fields of Alaska, by C. W. SOMMERVILLE.

The Andrews Case at Brown University, by C. H. BROUGH.

Lecky's "Democracy and Liberty," by G. L. P. RADCLIFFE.

Schouler's "Constitutional Studies," by C. SNAVELY.

November 19.

The Monetary Situation, by J. H. HOLLANDER.

Social England, by ST. G. L. SIOUSSAT.

Commercial Education in Europe, by D. E. MOTLEY.

Socialism and Statistics, by W. S MYERS.

The Historical Archives of Lombardy, by R. GARRETT.

Some Great Trusts, by W. T. THOM.

Bibliography of Education, by W. S. DREWRY.

Naturalists' Field Club.

October 12, 1897.—Election of Officers:—

President, B. W. BARTON; *Vice-President*, G. A. DREW; *Secretary*, C. E. WATER *Chairman Zoological Section*, GEO. LEFEVRE; *Chairman Botanical Section*, D. JOHNSON; *Chairman Geological Section*, A. G. LEONARD.

Papers and Reports:

Abundance of Fern Spores, by C. E. WATERS.

Sterculia platanifolia, by J. H. BRUMMELL.

Blue-green Algae, etc., by D. S. JOHNSON.

November 9.

Collecting in Jamaica, by E. W. BERGER.

Abnormal Oaks, by J. H. BRUMMELL.

Young Men's Christian Association.

September 25.—Opening of Levering Hall.

October 4.—Reception to New Students.

October 19.—University Settlement Meeting.

November 2.—Mr. A. L. Seth elected Member of Executive Council.

November 15-19.—Week of Prayer for Young Men. Short daily services, conducted members of the Faculty.

November 23.—Anniversary Address, by the Rev. OLIVER HUCKEL.

PUBLIC MEETINGS AND SOCIAL ASSEMBLIES

Recently held in the University Buildings:

A meeting in memory of Professor Humphrey and Dr. Conant, in the Donovan Roo October 3.

A reception by the Young Men's Christian Association of the University to the studen who have recently entered, in Levering Hall, October 4.

A reception by the Graduate Students' Association, in Levering Hall, October 8.

The annual meeting of the Maryland Homeopathic Medical Society, in Levering Hal October 19.

A meeting under the auspices of the Poor Association of Baltimore in furtherance the project for establishing sewing schools, in Levering Hall, October 27.

A session of the Maryland Public Health Association, in Levering Hall, November 1

First annual meeting of the Maryland Conference of Charities and Correction, in McCo Hall and Levering Hall, November 22 and 23.

SCIENTIFIC NOTES.

The Epic and Attic Use of the Circumstantial Participle. By G. M. BOLLING.

[Abstract of a paper read before the University Philological Association, October 19, 1897.]

The origin of the class of words that we call participles must be sought for in the adjective.—Paul, Principien der Sprachgeschichte, p. 308; Brugmann, Grund. II, 428; Gr. Gram., 196; Delbrück, Vgl. Syntax, 1, 477. A class of adjectival formations that have the appearance of being formed from the present or aorist stem as well as from the verbal root, could set the pattern for other analogical formations from the different tense stems, and in this way we should obtain a class of adjectival words in which the idea of time, which is only implied in the adjective proper, would be explicitly expressed, so that these words would come to designate an attribute that is temporally limited from the point of view of the speaker, and in this way would approximate to the nature of the verb. In other words the participle is an adjective with a richer content of meaning since it brings from its association with the verb the distinction of voice and tense and the power of verbal regimen. The adjective represents a quality at rest, the participle represents a quality in motion, and the difference between the two is a difference in the degree of mobility.—Cf. Schroeder, Über die formelle Unterscheidung der Redetheile, p. 86.

The special value of this formation is, as Paul points out, that it allows us to use the expression of an event in the form of an attribute. In this way it becomes an easy means for giving the subordinate details, the attendant circumstances of an action, without bestowing upon them a prominence that would distort the perspective; or, to phrase it differently, the participle serves to color while the finite verb gives the outlines of the action. —Cf. Dr. Gildersleeve, Pindar, cix; A. J. P., IX, 137 ff. This is the original function of the participle and the development of it in Greek is justly recognized by Jolly—see A. J. P., IX, 139 n.—as one of the chief factors that go to make up the superiority of the Greek language.

The work—The Participle in Hesiod[1]—of which this paper is a summary, was based on complete collections of the participle in Hesiod and in the Iliad. Its purpose was to see whether it could not be shown that the Greek development of the participle was essentially post-Homeric. Such a view of the development of the Greek participle is in opposition to the opinion expressed by Classen in his Beobachtungen über den homerischen Sprachgebrauch; cf. especially, p. 44, where he maintains that the Homeric use of the participle is in no respect inferior to that of the most highly developed Attic Prose. Classen's views have been criticised in detail by Dr. Spieker, A. J. P., VI, 310 ff. The chief reason for his lack of appreciation of the nature of the participle is his tendency towards "resolving" the participle into a finite subordinate clause, a tendency which was due no doubt to the poverty of the German language in participial constructions that Classen himself laments, and from which Vogrinz seems to have best succeeded in freeing himself. Cf. p. 278, when he waives all "resolutions" of the participle as purely logical operations; p. 248, when he speaks of the concessive sense of the participle as existing for our feeling for the language.

The original function of the participle was to express the subordinate details, the attendant circumstances of an action. The circumstances may stand in different logical relations to the main action of the sentence, but none of these relations ever receives formal expression in the participle except the relation of time. Originally, even this was no exception, for the tense of the participle expressed at first merely the "kind of time" of the subordinate action and not its temporal relation to the main action, since the notion of priority was not inherent in the aorist and was not completely attached to it until after the Epic period, as is shown by the use of the aorist participle in Epic poetry to express actions contemporary with the tense of the leading verb. Cf. Seymour, On the Use of the Aorist Participle in Greek; Trans. Am. Phil. Ass., 1881, pp. 88–96; Delbrück, Vgl. Syntax, 2, 482. Nevertheless under the pressure of the needs of translation into languages that are inferior to the Greek in their participial construction, grammarians have become accustomed to take these *logical* relations as the basis of their classification of the participle. Vogrinz is undoubtedly right in breaking from this tradition, only he might have gone farther and declared such resolutions to be injurious as tending to deaden the feeling for the difference between the participle and the finite subordinate clause.

Paul—p. 158 of the translation—lays down the principle that we cannot "maintain that the participial construction in itself admits of different meanings—*i. e.*, that it denotes now the reason, now the condition, now an opposition, etc. These relations remain in each case only 'occasional' and 'accidental.'" However, the participle is freely used in English, and still more freely in Attic Greek where the speaker *intends* that the hearer shall infer one of these logical relations, and we may then speak of the "use of the participle for abridging the sentence, that is, for representing temporal, causal and relative clauses" (Dr. Gildersleeve, A. J. P., IX, 138 n), of the participle as a conscious shorthand substitute for a subordinate clause.

As the intentional use of the participle in this way becomes more conscious, there will be a growing tendency to make the desired inference more unmistakable by the addition of particles to designate the relation between the main and subordinate actions. We should then recognize that the participle is a second stage of development behind which there is the possibility of a third. For the "occasional" use may pass into a part of the "usual" signification of the form, the particles may be felt to be unnecessary, and the participle may then be employed to *express of itself* the logical relation between main and subordinate action, though it is evident, of course, that if several of the participial constructions passed into this stage of development, there would result a state of confusion that could not long maintain itself in any language.

It is in the development along these lines of the participle as a substitute for a subordinate finite clause that the greatest and most essential difference between the Epic and the Attic use of the participle exists. Seymour calls attention to the fact that Homer frequently employs the finite verb where Attic prose would use the participle, *e. g.*

A 458: *αὐτὰρ ἐπεί ῥ' εὔξαντο καὶ οὐλοχύτας προβάλοντο*

instead of *εὐξάμενοι καὶ προβαλόμενοι*; and conversely we may say that while a sentence like "if you do not think of flight you will save the people" may be rendered into Attic by the participle, in Epic it can be expressed *only* by a finite subordinate clause. The extent of this difference is shown by the following figures: in Euripides—see Lodge, Participle in Euripides—the circumstantial participles, the participles that are not used as abridgments of temporal, causal, or conditional clauses, amount to only one-fifth of the total number of participles. In Hesiod—in spite of the fact that he is exceedingly fond of the adjectival use of the participle—they constitute considerably more than half the total. This shows that the reason why Epic poetry can employ the subordinate finite clause where Attic prose uses the participle and yet not become araiometochic, is because of the freer use of the pure circumstantial participle, and in this is to be found one of the main causes for the swiftness and vividness of Epic narrative. Even after making liberal allowances—which are necessary on account of the subjective nature of the work—for differences in drawing the line between circumstantial participles and those that are substitutes for subordinate clauses, the fact remains that we have here a difference in the syntax of the two periods which is fundamental and characteristic.

The difference that is indicated in this way is borne out by a detailed study of the different constructions. The adversative participle is the one that established itself most firmly in Greek, and that it must have done so at an early period is shown by the fact that it has become the chief mode of expression for the adversative relation. Accordingly, it is not surprising to find it in the Homeric poems in the second stage of its development, freely used with particles to make the meaning unmistakable. Later, these warning particles are felt to be unnecessary, and then it may be fairly claimed that the adversative relation is felt to be a part of the usual signification of the participle. The following table will show the difference between the Epic and Attic usage:

	Il.	Od.	Hes.	Eur.	Xen. An.
With particles,	150	104	15	36	14.
Without particles,	32	39	1	414	63.

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[1] Reprinted from The Catholic University Bulletin, Vol. III, pp. 421–471, Washington, 1897.

In this connection it may be well to call attention to the range of *καίπερ* in the Orators: Antiphon, Andocides, Lysias, Hyperides and Deinarchos do not use it at all (2.6; 6.11, belong to Pseudo-Lysias). Isaeus 6.54 and Lycurgos 75 have but one example; Aeschines has two 1.45, 167. Isocrates uses it in his letters 2.14; 4.1, 8; 9.16, and in passages of a similar character in his speeches 9.11; 11.9; 12.1; 15.11, 272, 320. Demosthenes is freer in his usage.[1]

Of the remaining constructions, the finite temporal clause is the one which the participle could replace with the greatest ease, because it contains in its tense an explicit designation of time. For this reason also it is especially hard to determine when the participle is merely circumstantial and when the author employs it with the intention that his audience shall infer the temporal relation between the two actions. There are in Hesiod about fifty examples in which the participle seems to be used to date as it were the time of one action with reference to another, and the construction seems to be in about the same state in the Iliad. There is, however, one test which is not subjective and which shows clearly the difference between Attic and Epic—the use of particles to make the inference unmistakable. Kühner, Krüger and Goodwin declare that this is frequent in Attic, while in Epic we have only a few examples, generally from the Odyssey and the latest parts of the Iliad.

The causal and conditional uses of the participle are even rarer, and it is to be noted that there is not a single case in which a particle is employed to render the inference of such a relation unavoidable. The use of the future participle to express purpose is, as well known, confined to verbs of motion—the construction with *ὡς* that afterwards becomes a form of oratio obliqua is unexampled. But it is interesting in connection with Hopkins' view (The Aryan Future, A. J. P., XIII, 1 ff.) that the future originally designated intention and not merely future time, to observe that the desiderative participles are subject to exactly the same limitations.

For the limitations of the gen. abs. I will refer to Dr. Spieker's article, A. J. P., VI, 310 ff., and merely call attention to the fact that the greater frequency of the construction in Hesiod contains an interesting confirmation of his theory of the temporal origin of the construction. Dr. Spieker observes, p. 342, "A number of the examples in Homer involve expressions of time as *ἔτεος* and *ἐνιαυτοῦ*." Now the increase of the construction in Hesiod is due to the large number of similar expressions that were demanded by the nature of his work *ἠοῦς γεινομένης*, *ἔαρος νέον ἱσταμένοιο*, *μηνῶν φθινόντων*, *ἐς τέλος ἐλθόντος θέρεος*, *ἐπιπλομένων ἐνιαυτῶν*, etc.

But the most interesting proof of the undeveloped state of the participle as a substitute for a subordinate clause is to be found in the use of the participle with the negative. Originally the negatives *οὐ* and *μή* were employed only with finite verbs, participles and infinitives being negatived by composition with the negative prefix. Relics of this stage are to be seen in *ἀέκων ἀεκαζόμενος ἀφρονέοντες* and in the use of *οὔ φημι*. Monro considers the first exception to this rule in Greek to have been the use of *οὐ* with the participle, a usage which he declares is well established in Homer.

The use of *οὐ* and *μή* with the participle can have arisen in two ways: first, by displacement of the syntactical distribution; and second, owing to the feeling that the participle was an equivalent for a subordinate clause. The examples in Epic poetry, which are not so frequent as Monro's statement would lead one to expect, show plainly that they are due to displacement of the syntactical distribution, and in most cases the manner of the change is still visible. Thus in a sentence like "he did not slay him playing the coward but [he slew him] standing in front of the Trojans," the negative which originally belongs to the verb tends owing to the contrast to be felt as belonging to the participle—"he slew him not playing the coward but standing in front of the Trojans."

Ω 214. *ἐπεὶ οὔ ἑ κακιζόμενόν γε κατέκτα*
ἀλλὰ πρὸ Τρώων - - - - - ἑστεῶτα.

In this case, of course, the negative will be the negative that was used with the leading verb. This is of importance in determining the question whether the character of the leading verb can affect the choice of the negative of the participle, and as this is the first way in which the negatives *οὐ* and *μή* come to be attached to the participle, the question must, I think, be answered in the affirmative.

The absence of the negative *μή* with the conditional participle is evidently due to the fact that the use of the participle as a substitute for a conditional clause had not yet developed, and it is for a similar reason that other combinations of the negative with the participle (except with the adv. part. and where coming from displacement of the syntactical distribution) are extremely rare. Delbrück, Vgl. Syntax, 2, 531, argues rightly that the participle gives up its combination with the negative prefix as it approaches the nature of the finite verb. But the argument may be carried farther: in Attic prose the participle is found freely combined with the negatives that originally belonged to the finite verb, in Epic poetry we see only the beginnings of such a usage, and I think that we are justified in seeing in this difference clear proof of a still farther advance of the participle towards the finite verb, or in other words of the development of the participle as a shorthand substitute for a subordinate finite clause.

The Maryland and Virginia Boundary Controversy.

By Louis N. Whealton.

In some sixty pages, the author has told the story of the long controversy between Maryland and Virginia over their common boundary. This is the first complete account of the controversy which has yet been attempted, and together with the monograph, "The Early Relations between Maryland and Virginia," by J. H. Latané, Ph. D., forms a full history of interstate relations.

This dispute arose about the year 1660 and continued until 1894, having the following points at issue:

1. The western end of the line which was to divide Maryland and Virginia was described, in the charter to Lord Baltimore in 1632, as "the First Fountain of the Potommack." The Potomac river has two branches called the North and South branch respectively. Maryland claimed that the South branch was the "First Fountain" and that the land between these two branches was hers. Virginia disputed this claim and pronounced the North branch to be the first source. The land between the two branches was, at last, yielded to Virginia. Maryland decided to accept the North branch as the true source, in the hope that an extension westward would offset the loss of the land between the two branches. In this Maryland was disappointed, for Virginia insisted that Maryland should not only accept the North branch as the true source, but must also begin her western boundary at the Fairfax stone. This stone was planted several miles from the headwaters of the North branch, and when Maryland, in 1852, agreed to this site as the beginning of her western boundary, all hopes of westward expansion were abandoned. The Civil War came on, and West Virginia fell heir to this boundary difficulty with Maryland. The line between Maryland and West Virginia has not yet been located.

2. Maryland claimed also the entire Potomac river under her charter. Virginia disputed the claim on similar ground. A Board of Arbitrators marked out the boundary, in 1877, and gave the river to Maryland, so that Maryland's southern boundary to-day is to the southern bank of the Potomac. A notable event, in the history of this portion of the boundary, was the "Compact of 1785." The Articles of Confederation had made no provision for federal control of commerce or the regulation of interstate traffic. Maryland and Virginia agreed to certain commercial regulations known as the "Compact of 1785," and this action brought out clearly one of the chief weaknesses of the Articles of Confederation, and was the precursor of those conventions which led to the formation of our present Federal Constitution.

3. The place where the boundary between the two colonies should strike the eastern side of the Chesapeake Bay, was called "Watkins' Point," by the charter of 1632. The location of this point was in dispute from 1660 to the final settlement in 1894. Virginia claimed that the point was farther north than it is at present, while Maryland held it to be about where it is now. When the arbitrators located Watkins' Point on the map they conceded Maryland's claim.

4. Maryland and Virginia had entered into the agreement known as the "Compact of 1785," for the protection of shipping and punishment of crimes upon the waters which formed their common boundary. About a century afterwards, Virginia excluded Maryland from taking oysters in Pocomoke Sound. Maryland claimed a right to these oysters, in commo

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[1] Dr. Bloomfield and Dr. Gildersleeve call attention to the fact that both in Sanskrit and in Greek the adversative signification is the predominant one in the rarer absolute construction—in the genitive absolute in Sanskrit and in the accusative absolute in Greek.

with Virginia, under the terms of the "Compact." These oyster beds had become very valuable, and were estimated at this time to be worth twenty millions of dollars. The Supreme Court of the United States was appealed to and asked to construe the agreement of 1785 upon the point in question. This the Court did in 1894, and the decision was that the "Compact of 1785" gave Maryland no right to take oysters in Pocomoke Sound. The Board of Arbitrators, which had been agreed upon by the two States and which had settled the disputes as to the Potomac and Watkins' Point, had failed, in their award of 1877, to define accurately the term "head land." Upon the meaning of this word grew up a large part of the dispute which was settled by an appeal to the "Compact of 1785" and the decision of 1894.

The sources for the above were chiefly the various boundary reports and acts of legislatures in each State. Manuscript material, comprising the McDonald and De Jarnette Papers at Richmond, was also consulted upon the main points in the early part of the dispute.

Maps accompany the monograph, so that the various changes in the line and conflicting claims are made plain.

Early Development of the Chesapeake and Ohio Canal Project. By George W. Ward.

About 1748, the Ohio Company was chartered by Virginia for the purpose of taking possession of a large tract of land in the valley of the Ohio upon which had already been turned the covetous glances of the French from Canada. The Ohio Company at once established a trading post on the site now occupied by the city of Cumberland, whence an Indian trail led westward to the Ohio.

In 1775, Braddock's route to Fort Duquesne was selected upon economic rather than upon military grounds, hence the disastrous failure of the expedition. Governor Dinwiddie, of Virginia, and others interested in the Ohio Company were influential enough to procure the ordering of the Potomac route in order that their lands on the Ohio might be opened up by the road which Braddock would be compelled to make. In this way, as early as the beginning of the Seven Years' War, the Potomac route had become a factor in international politics.

A system of internal improvement to be undertaken by the Federal Government was favored by every president of the United States from Washington to John Quincy Adams. Some of them, however, especially Jefferson and Madison, believed an amendment to the constitution necessary to confer upon Congress the right to undertake such a system. But such an amendment, though several times proposed, was never received with favor, and in 1817 Congress passed an act for the inauguration of a system of internal improvement by the Federal Government without an amendment. The bill was promptly vetoed by President Madison, and for several years afterward little was done by the Federal Government in the matter of internal improvement. The National Road was the standing argument against the necessity of an amendment, while the friends of internal improvement urged the right of Congress to provide for the national defense and to regulate commerce as conferring the necessary power upon the Federal Government.

Meanwhile, there had sprung out of the failure of the Potomac Company an independent movement for a navigable canal from tidewater in the Potomac to the Ohio, and ultimately to the Great Lakes. To mature the necessary plans a convention, since known as the Chesapeake and Ohio Canal Convention, assembled in the hall of the Supreme Court in the Capitol at Washington in November, 1823. In this way the attention of the Federal Government was again called directly to the subject of internal improvement, and, upon the recommendation of the President, Congress passed an act, 1824, authorizing the creation of a United States Board of Internal Improvement. The surveys for the proposed Chesapeake and Ohio Canal were at once begun by the Board.

As a further result of the Convention of 1823, the concurrence of Virginia, Maryland, Pennsylvania and Congress in a charter was secured, and in June, 1828, the Chesapeake and Ohio Canal Company was formally organized, Mr. Charles Fenton Mercer, of Virginia, being chosen president. Within a few weeks the Potomac Company transferred all its rights, privileges, and franchises, by a deed of surrender, to the new company, and, on July 4, 1828, in the presence of the members of the cabinet, those members of the diplomatic corps, who happened to be in Washington, and a great crowd of interested spectators, ground was broken for the canal by John Quincy Adams, President of the United States, who said, "I consider this the most fortunate event of my life."

On the same day, and perhaps about the same hour, ground was broken in Baltimore by the venerable Charles Carroll of Carrollton for the Baltimore and Ohio Railroad. A legal controversy between the rival enterprises, begun two or three months later because the railroad was locating its line above Point of Rocks on the ground previously occupied by the canal, prevented either work from proceeding further than Point of Rocks until the final settlement of the controversy in favor of the canal in 1832. By that time the Canal Company, which had been subjected to ruinous delay and heavy losses, had become bankrupt; public opinion had decided in favor of the railroad; Congress refused any further assistance to the Canal Company, and the project, like its predecessor, failed. The revival of the enterprise under the patronage of Maryland and in greatly modified form marks the beginning of a distinct history.

The Labadist Colony in Maryland. By B. B. James.

The Labadists were the earliest religious communal sect to be established in America. Bohemia Manor, in what is now Cecil County, Maryland, was the place of their settlement. Here they sought to develop the principles of their religion, which provided for a community of possessions, a system of vigorous self-denial and self-abasement, and the allotment of labor for the general weal, by the bishop as superintendent of the colony. In economic and disciplinary matters the power of the bishop was absolute and was often arbitrarily exercised. In matters distinctively spiritual he was assisted in his deliberations by a council of persons with semi-clerical functions, called "Speaking brothers and sisters." To these latter, in connection with a class of Bible readers, was committed the care of the children of the community.

Though not distinctively a millennial sect, Labadists cherished adventist hopes, which had an important influence in shaping their doctrines. Unworldliness was the key-note. This led to the belief that they constituted the elect church in which alone was to be found salvation. In consequence of this belief it was made imperative that the novice, before being received into full fellowship, should leave husband or wife, as the case might be, if not of the Labadist persuasion.

As Labadism was essentially a mystical form of faith, supreme reliance on the immediate communication of the Holy Spirit was a cardinal doctrine. Though the Bible was publicly read and expounded, yet it was believed that the Spirit was not dependent upon any medium of communication, and that without the aid of the Bible or any other intermediary agency, the soul of the believer could not fail to be immediately instructed in all sound doctrine. It was their accentuation of this tenet that led William Penn and his companions, Barclay and Keith, to make to the Labadists overtures of union with the Society of Friends. The mystical spirit of their faith led to peculiarities of teaching with regard to the Lord's Supper and the ordinance of baptism.

The theology of the Labadists belongs to the Calvinistic school, though divergent in many particulars. It was founded on an abstruse system of particular and general covenants. The Labadist system received its contributions from three sources: (1) the personality of its founder, who contributed the mystical element; (2) rigid discipline and asceticism, which were derived from the Society of Jesus, and (3) theology, largely drawn from that of the reformed churches.

The founder of Labadism was Jean de Labadie, a French mystic, born at Bordeaux in 1610. He received his education at a Jesuit college and united himself with that order. He successively became a Jansenist, a Carmelite and a Protestant minister. He acquired celebrity as a preacher of great eloquence in his Protestant connection, and his name became famous in all the Protestant countries of Europe as that of a remarkable preacher and profound theologian. He attracted the attention of the theologians of Utrecht, and for a time it seemed that he would be the last expression of the evangelical party in the Reformed Church of the Netherlands. Voetius and Lodenstine, the eminent theologians of the

University of Utrecht, who stood for the Voetian as opposed to the Cocceian theology of the church—representing respectively the Aristotelian and Cartesian schools of Philosophy—hoped that in Labadie would be found the practical reformer who should apply their tenets to the renovating of the church.

Having become seriously involved with the Reformed Church, Labadie ultimately became the founder of an independent church which he styled the Evangelical. It was this church which, after great vicissitudes, became established at Harwood, Friesland, where its peculiar system was more perfectly wrought out, and whence were sent those colonists who settled on the soil of Maryland in 1683.

Bohemia Manor, the place of the settlement, was the estate of Augustine Herman, a Bohemian adventurer, who had received from Lord Baltimore extensive tracts of land in what is now Cecil County, Maryland, and New Castle County, Delaware, in consideration of drawing for Lord Baltimore a map of Maryland and Virginia to assist him in the settlement of the boundary disputes between the two colonies.

The Labadist colony never numbered much more than a hundred persons, and in half a century from its founding it had become extinct. Its rigid discipline, its asceticism and its seclusion prevented it from attaining any extensive growth or exercising any commanding influence, while economic advantage gradually came to supplant religious motive. Yet a number of families of distinction in Maryland affairs derived their origin from the colony. Of these may be mentioned the Bayards and Bouchelles.

On the Study of Natural History in Japan.

By K. MITSUKURI (Ph. D., Johns Hopkins), Professor of Zoology in the University of Tokyo and President of the Tokyo Zoological Society.

(Reprinted from Introduction to Annotationes Zoologicae Japonenses, Vol. I, 1897.)

"It is probably unknown to most persons in the West that early in the eighth century of the Christian era there was already established in Japan an Imperial University with four departments,—Ethics, History, Jurisprudence, and Mathematics—and with the prescribed number of four hundred students. There were also at the same time a bureau devoted to Astronomy, Astrology, Calendar-Compilation and Meteorology, and a Medical College with professors of Medicine, Surgery, Acupuncture, Necromancy (the art of healing by charms), and Pharmacology. The last-named branch of study included the collection, cultivation, and investigation of medicinal plants, and thus a considerable amount of botanical knowledge must already have been acquired by that time. Toward the end of the ninth century, when a catalogue of books existing in Japan was compiled by the order of the then reigning Emperor, the Imperial library was found to contain 16,790 volumes, divided into forty departments,—and this in spite of a disastrous fire of some years previous. Among the medical works were some with very modern-sounding titles, such as "The Curing of Diseases of Women," and "On the Methods of Healing Diseases of the Horse." Japan in those early days derived its culture from India, China, and Corea, but the details above enumerated clearly show that educated society must already have attained a high degree of civilization.

"Coming to more modern times, it is known that during the long peace of two hundred and fifty years which the rule of the Tokugawa *shoguns* secured for Japan, literature, the arts, and all peaceful industries were developed with remarkable vigor and rapidity, and that the study of Natural History shared in this progress. Apart from that innate love of Nature and the natural which was ever showing itself in poetry and other arts, the study of natural products was always pursued, ostensibly with the purpose of collecting *materia medica*, or of discovering things that might be used as food in case of a famine, or of identifying objects mentioned in the Confucian classic, "Shi-King." But it is not difficult to perceive that naturalists looked in reality beyond these simple or utilitarian ends, and investigated animals and plants for their own sake, although the principal aim of their researches seems to have been the comparatively barren one of establishing a relationship between Japanese products and those described in various Chinese works on Natural History. * * * * * *

"With the Restoration of the Emperor to his full power, in 1868, came the wholesale reconstruction of all political institutions, and the country has been, and is still, going through such a social revolution as has seldo been witnessed in any part of the world. Along with many other thing the old school of Natural History was swept away, as chessmen from th board at the end of a game. So far as our science is concerned, there is complete break at this period. The modern school of Zoology dates fro the appointment of Prof. E. S. Morse, of Salem, Mass., U. S. A., to the cha of Zoology at the University of Tokyo, in 1877. His indefatigable zeal an genial manners won many friends for the new science among all classes society, while his lectures, popular or otherwise, drew attention for the fir time to the immense strides which our science, under the stimulus of Da winism, was making in the West. He, with a few students under him, al soon had in working order a tolerably good museum—the nucleus of th present Zoological and Anthropological collections of the Science Colleg It was also during his stay and through his care that the Tokyo Biologic Society, from which the Tokyo Zoological Society is directly descended, w first organized. It is truly wonderful how much he accomplished in th brief time he was in Japan. On the return of Prof. Morse to America, h was succeeded by Prof. C. O. Whitman, now of Chicago. It was the latt who first introduced modern technical methods. These two American thus stood sponsors to the modern school of Zoology in Japan.

"Since 1881, the development of Zoology in this country has been entirel in the hands of Japanese. The spirit of earnest study which signalized th Natural History School of the pre-Restoration days is happily revived, b with higher and wider purposes, and with greater facilities for successf attainment. Though only twenty years have passed since the "new depar ure," a vigorous school of Zoology has already sprung up. I shall perha not be overstepping the bounds of modesty if I say for my *confrères* that more earnest, more enthusiastic, or more industrious set of men could wi difficulty be found anywhere.

"There can be no doubt that the establishment of the Marine Station Misaki by the Imperial University, in 1887, gave a great impetus to th study of Zoology in Japan. Situated at the point of the peninsula jutti out between the Bay of Sagami and the Bay of Tokyo, it has access localities long since famous as the home of some remarkable forms of an mal life. Along the coast, all sorts of bottoms are found, yielding a ri variety of animal forms, while the hundred-fathom line is within two three miles of the shore, and depths of five hundred fathoms are not ve difficult of approach. The existence of a remarkable deep-sea fauna these profounder parts has been ascertained within the last few years, a zoological treasures are now being constantly hauled up. The great "Bla Current" (*Kuro Shiwo*) sweeps by, not many miles out, and a branch of often comes into the very harbor of Misaki, gladdening the heart of th Plankton explorer. Face to face with this inexhaustible treasury of an mal forms, the zoologist will have to possess unusual powers of self-restrain indeed, not to grow enthusiastic over his science.

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"The prospects of our science in Japan have never been brighter th they are at this time. All its main branches, including applications it to practical purposes, such as Fisheries, Sericulture, Entomology, et are now fairly represented. Each year will see gradual additions to th specialists of different groups, as the number of graduates from the Imperi University increases. The Marine Station at Misaki, which has becon too small for our growing body, will be removed within the present year a new site, about two miles north of its present location, and its accommod tions will be considerably enlarged. While perhaps not essential to th pursuit of science, the extreme beauty of the situation, which commands matchless view of Fujiyama and the Sagami Bay, will certainly not less its attractions; and an additional charm to those who are interested in th heroic achievements of the past may be found in the associations with whic the spot abounds, as the ancient stronghold of a mighty warrior chiefta who was killed here in a desperate battle, after sustaining a long siege, a whose spirit is believed by the populace still to haunt the scene of h former greatness. A proposed railway, passing near the new site, will bri the station within two or three hours of Tokyo. A number of teache scattered over different parts of the country are acting somewhat as sent nels at the outposts of our science, and doing good service in collecting an mals from different localities. Our field of activity has also lately bee suddenly widened by the addition of Formosa to the territory of Japan, a the work of a collector now on that island will, it is hoped, be but the for runner of many similar undertakings."

THE DEATH OF DR. JAMES CAREY THOMAS.

Born in Baltimore, July 13, 1833.

Died in Baltimore, November 9, 1897.

The friends of Dr. James Carey Thomas, connected with the Johns Hopkins University, assembled Sunday afternoon, November 14, in Levering Hall, the rooms of the Young Men's Christian Association, for the purpose of giving expression to their sentiments of respect and affection. The Trustees, the Faculty, and the Students were represented.

The chair was taken by Mr. C. Morton Stewart, President of the Board of Trustees. A biographical sketch was read by Professor Wood, and the following minute, presented by President Gilman, was then adopted. In confirmation of what is there said, remarks were made by Dr. Welch, Dean of the Medical School, on the services of Dr. Thomas to medical education; by Professor Griffin, Dean of the Collegiate Department, on the religious characteristics of Dr. Thomas; by Professor Haupt, on his personal relations, and on his liberality toward those from whom he differed; and by Professor Remsen, on his philanthropic work.

Mr. Joshua Levering made the concluding remarks, in which he gave expression to the grief of the people of Baltimore not connected with the University, as well as of those within its walls, at the death which has come so unexpectedly.

MINUTE.

The friends of Dr. James Carey Thomas, connected with the Johns Hopkins University, assembled Sunday afternoon, November 14, 1897, for the purpose of showing their affection and respect, adopt the following minute, and request the Trustees of the University to make it a part of their official records:—

Dr. Thomas has been a Trustee of this University since 1870. He was the first person elected by the original Trustees to take a seat in the Board, and at the time of his death he was one of three, still members of the Board, who took part in the organization of this institution, on the death of the founder, nearly twenty-four years ago. He believed that Baltimore had then an opportunity such as had never before occurred in this country to establish a university of the highest character, which would be of service to the State, the country, and the world. Whatever tended toward the attainment of this ideal received from him unfailing encouragement.

He thoroughly appreciated the university spirit, and every endeavor to secure the advancement of higher education for men and for women, the improvement of scholarship, the promotion of research, or the calling and retention of qualified professors, was sure to have his approbation and aid.

In looking back upon his services it is impossible to say in which department of work he was most interested—the literary, the scientific, or the medical. To each in turn he gave his hearty support, but his training as a physician enabled him to render noteworthy services in the organization of the School of Medicine. In recognition of this capacity the Trustees of the Hospital made him, as a member of the Medical Board, one of their professional advisers.

He traveled much, especially in England and the United States, and wherever he went he came into relations with the active and intelligent promoters of advancing knowledge, and with the leaders of public opinion. He brought home their experience and suggestions. He loved flowers, music, poetry, lectures, charities, and especially the social assemblies of his friends for religious, philanthropic, or professional conference. His Christian character was always manifest, but never in a dogmatic or oppressive aspect. In the welfare of the students, especially as it is promoted by the Young Men's Christian Association, he took a lively interest.

Although he had strong convictions, which did not quickly yield to persuasion, he allowed to others the freedom of thought and action which he claimed for himself, and he acquiesced without opposition in the conclusions to which his colleagues came. His enthusiasm was never at rest. He firmly believed that whatever obstacles the University might encounter its future was assured. This cheerful courage was inspiring to the staff of teachers. It made him their welcome adviser and their constant friend.

His simple, open, hearty greetings, his cheerful smile, his ringing voice, his dislike of forms and ceremonies, and the assurance of his sympathy, will always be remembered by those who knew him; and those who come after us, never having seen his face, will share, unconscious heirs, in methods, opportunities, and advantages due, in no small measure, to his fidelity and forethought.

As we lay upon his tomb this tribute of gratitude and affection, we recall, appropriate to his memory, these words of Lord Bacon: "It is a heaven upon earth when a man's mind rests upon Providence, moves in Charity, and turns upon the poles of Truth."

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THE JOHNS HOPKINS PRESS.

LIST OF SERIAL PUBLICATIONS.

I. American Journal of Mathematics.

This journal was commenced in 1878, under the editorial direction of Professor Sylvester. It is now conducted by Professor T. Craig as Editor, with the coöperation of Professor Simon Newcomb. Nineteen volumes of about 400 pages each have been issued, and the twentieth is in progress. It appears quarterly. Subscription $5 per year. Single numbers $1.50.

A very few complete sets remain. These will be sold for one hundred dollars per set.

II. American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as Editor. Nineteen volumes of about 450 pages each have been issued, and the twentieth is in progress. Ten numbers are issued yearly. Subscription $4 per year. Single numbers 50 cents.

III. American Journal of Philology.

The publication of this journal commenced in 1880, under the editorial direction of Professor Gildersleeve. Seventeen volumes of about 570 pages each have been issued, and the eighteenth is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1. Only a few sets remain in the hands of the editor.

IV. Studies from the Biological Laboratory.

The publication of these papers commenced in 1879, under the direction of Professor Martin, with the assistance of Professor W. K. Brooks. Four volumes of about 500 pages, octavo, and 40 plates each, have been issued.

V. Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Professor H. B. Adams. Fifteen series are now completed and the sixteenth series in progress. Sixteen extra volumes have also been issued. Subscription $3 per volume. A set, including the sixteen regular series and the sixteen extra volumes, will be sold for seventy dollars.

VI. Memoirs from the Biological Laboratory.

These monographs are issued under the editorial direction of Professor W. K. Brooks. Volume IV is in progress. Price for the set of three volumes twenty-five dollars.

VII. Johns Hopkins University Circulars.

The publication of these Circulars began in December, 1879, and 133 numbers have since been issued. Subscription $1.00 per year.

VIII. Contributions to Assyriology and Comparative Semitic Philology.

The publication of these papers was begun in 1889. Professor Paul Haupt, of the Johns Hopkins University, and Professor Friedrich Delitzsch, of the University of Breslau, are the editors. Volume III in progress.

IX. The Johns Hopkins Hospital Reports.

These reports are edited by the Faculty of the Johns Hopkins Medical School and published for the Johns Hopkins Hospital. Their publication was begun in 1890. Volume VII is in progress. Subscription $5 per volume. The set of seven volumes will be sold for thirty-five dollars.

X. The Johns Hopkins Hospital Bulletin.

The publication of these Bulletins began in 1889. Volume IX
progress. They are published monthly. Subscription $1.00 per yea
The set of nine volumes will be sold for fifteen dollars.

XI. Modern Language Notes.

This journal is edited by Professor A. M. Elliott and his associates
Modern Language Department. It appears monthly. The twelfth
is in progress. Subscription $1.50 per year.

XII. The Journal of Experimental Medicine.

This journal began publication in 1896. It is edited by Professor
Welch with the coöperation of a number of associates. It appears si
yearly. Volume III is in progress. Subscription $5.00 per year.
of set of three volumes twenty dollars.

XIII. American Journal of Insanity.

This journal is edited by Professor Henry M. Hurd and his as
editors. It appears quarterly. Subscription $5 per year.

XIV. Annual Report,

Presented by the President to the Board of Trustees, reviewing the
tions of the University during the past academic year.

XV. Annual Register,

Giving the list of the officers and students and containing detaile
ments as to the regulations and work of the University.

Announcements of the Graduate, Collegiate and Medical Cou
Instruction are issued yearly and will be sent on application.

The principal separate publications issued by the Johns Hopkin
are:

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A. Rowland. Set of ten plates, $20.

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Ment. Now in progress. Prospectus on application.

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Geology and Physical Features of Maryland. By G. H. W
and W. B. Clark. $1.00.

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More. $1.00 each.

Description of the Johns Hopkins Hospital. 116 pages,
56 plates. $7.50.

Selections from the Early Scottish Poets. By William
Browne. $1.25.

A Monograph on the Genus Salpa. By W. K. Brooks. 40
and 57 plates. $7.50.

Dissertations for the Degree of Doctor of Philosophy
Johns Hopkins University.

Orders should be addressed to the Johns Hopkins
Baltimore, Md.

The Johns Hopkins University Circulars are issued monthly. They are printed by Messrs. JOHN MURPHY & CO., No. 44 West Baltimore Baltimore. Subscriptions $1.00 a year, may be addressed to THE JOHNS HOPKINS PRESS, Baltimore; *single copies will be sent by mail for ten cen*

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JOHNS HOPKINS UNIVERSITY CIRCULARS

Published with the approbation of the Board of Trustees

. XVII.—No. 134.] BALTIMORE, MARCH, 1898. [PRICE, 10 CENTS.

ENUMERATION OF CLASSES, SECOND HALF-YEAR, 1897-98.

thematics. (69 Students).

asses meet in the Physical Laboratory, except as otherwise stated.

lvanced Theory of Functions: Professor CRAIG. Monday, uesday, and Thursday, 9 a. m., Room 26. (4).

Eiesland.
Hardy.
James, G. O.
McInnes.

eory of Surfaces: Professor CRAIG. Monday, Tuesday, and hursday, 10 a. m., Room 26. (4).

Eiesland.
Hardy.
James, G. O.
McInnes.

athematical Conference: Professor CRAIG. Friday, 9 a. m., oom 26. (4).

Eiesland.
Hardy.
James, G. O.
McInnes.

ementary Theory of Functions: Dr. CHESSIN. Monday and uesday, 11 a. m., Room 26. (6).

Eisenhart.
James, G. O.
McInnes.
Ortmann.
Rabinovitch.
Reese, H. M.

eoretical Mechanics: Dr. CHESSIN. Monday and Wednesday, 2 m., Room 26. (4).

Eiesland.
Hardy.
James, G. O.
Rabinovitch.

liptic Functions: Dr. CHESSIN. Tuesday, 12 m., and Wednesday, 10 a. m., Room 31. (1).

James, G. O.

eory of Numbers: Dr. COHEN. Wednesday and Friday, 10 a. m., hursday, 11 a. m., Room 26. (4).

Eiesland.
Eisenhart.
Hardy.
Rabinovitch.

eory of Equations; Modern Geometry; Solid Analytic Geometry: (*Major Course*): Dr. HULBURT. Daily, except Monday, a. m., Room 27. (9).

Bestor.
Earhart.
Eisenhart.
Ford.
Haulenbeek.
Meyer.
Potts.
Routh.
Whitehead.

ifferential and Integral Calculus: (*Minor Course*): Dr. HULBURT. Daily, except Friday, 1 p. m., Room 26. (25).

Altvater.
Baetjer, H.
Beale.
Beeuwkes, C. J.
Bird.
Brooks, C. E.
Byers.
Donaldson.
Douglas.
Flinn.
Ford.
Foster, F.
Foutz.
Francis, I. H.
Gminder.
Howard.
Hyde.
James, R.
Kerr.
Liddell.
Mackall.
Powell.
Smith, W. L.
Turnbull.
Wirt.

ifferential Equations: (*Undergraduate Elective*): Dr. COHEN. uesday and Thursday, 8 a. m., Room 27. (18).

Armstrong, J. R. C.
Beeuwkes, R. K.
Earhart.
Edmunds.
Eisenhart.
Everett.
Fitzgerald.
Frank, E.
Lucke.
Martin.
Meyer.
Ortmann.
Pender.
Potts.
Rabinovitch.
Reese, H. M.
Swaine.
Whitehead.

igonometry; Elementary Analytic Geometry: Dr. OHEN. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., hursday, 12 m., Room 7, McCoy Hall. (10).

Bernheim.
Constantine.
Diggs.
Homer.
Morrison.
Snavely, G. E.
Stein, L. D.
White.
Wight.
Wright, H. C.

Physics and Astronomy. (94 Students).

Classes meet in the Physical Laboratory.

Light: Professor ROWLAND. Daily, except Wednesday, 10 a. m. (8).

Harrison, C. N.
Mendenhall.
Penniman.
Rhoads.
Rothermel.
Saunders, F. A.
Schenck.
Waidner.

Physical Seminary: Dr. AMES. Saturday, 9 a. m. (11).

Bliss.
Dorsey, N. E.
Harrison, C. N.
Mendenhall.
Mitchell.
Penniman.
Rhoads.
Rothermel.
Saunders, F. A.
Schenck.
Waidner.

Journal Meeting: Professor ROWLAND and Dr. AMES. Wednesday, 11 a. m. (23).

Bliss.
Dorsey, N. E.
Earhart.
Edmunds.
Harrison, C. N.
Huff.
James, G. O.
Jones, H. C.
Martin.
Mendenhall.
Meyer.
Mitchell.
Ortmann.
Penniman.
Potts.
Reese, H. M.
Reid, H. F.
Rhoads.
Rothermel.
Saunders, F. A.
Schenck.
Waidner.
Whitehead.

Hydrodynamics: Dr. AMES. Thursday and Friday, 11 a. m. (19).

Earhart.
Edmunds.
Harrison, C. N.
Huff.
James, G. O.
Martin.
Mendenhall.
Meyer, J. F.
Mitchell.
Ortmann.
Penniman.
Potts.
Reese, H. M.
Rhoads.
Rothermel.
Saunders, F. A.
Schenck.
Stuart, T.
Waidner.

Physics: (*Major Course*): Dr. AMES. Daily, except Thursday, 12 m. (21).

Armstrong, J. R. C.
Beale, R. B.
Bestor.
Earhart.
Eisenhart.
Fitzgerald.
Frank, E.
Haulenbeek.
Huff.
Lucke.
Martin.
McInnes.
Meyer.
Ortmann.
Pender.
Potts.
Rabinovitch.
Smith, F. W.
Straus.
Whitten.
Young.

Physics: (*Minor Course*): Dr. AMES. Daily, except Tuesday, 10 a. m. (41).

Abercrombie.
Altvater.
Berkeley.
Blanchard.
Bouchelle.
Breed.
Bruce.
Caso.
Cooper.
Donaldson.
Douglas.
Foutz.
Francis, J. H.
Geraghty.
Glaser.
Greene, C. W.
Herrick.
Horn.
Howard.
James, R.
L'Engle.
Liddell.
Mackall.
McAll.
Meisenhelder.
Morrison.
Remsen, C. M.
Robinson, G. C.
Rogers.
Rous.
Routh.
Russell.
Seth.
Simmons.
Smith, S. P.
Taneyhill.
Turnbull.
Wight.
Williams, D.
Winslow.
Winston.

Applied Electricity: (*Second Year*): Dr. DUNCAN. Monday and Tuesday, 9 a. m., Room 24. (12).

Bartell.
Brady, W. B.
Edmunds.
Frank, E.
Gorsuch.
Haldeman.
Hodges, W. L.
Keidel, F. B.
Kershner.
Martin.
Ortmann.
Spencer.

Applied Electricity: (*First Year*): Dr. DUNCAN. Thursday and Friday, 9 a. m., Room 24. (11).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Brady, W. B.
Edmunds.
Everett.
Frank, E.
Haldeman.
Ortmann.
Stephens, J. C.
Swaine.

Electrical Measurements: Mr. HERING. Monday and Friday, 10 a. m., Room 27. (11).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Brady, W. B.
Everett.
Frank, E.
Haldeman.
Martin.
Ortmann.
Stephens, J. C.
Swaine.

Steam Engine: Mr. Geer. Wednesday, Thursday, and Friday, 11 a. m., Room 27. (7).

Bartell.
Gorsuch.
Haldeman.
Hodges, W. L.
Keidel, F. B.
Kershner.
Spencer.

Strength of Materials: Mr. Geer. Monday and Tuesday, 11 a. m., Room 27. (7).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett.
Haulenbeek.
Stephens, J. C.
Swaine.

Electrical Seminary: Dr. Duncan, Mr. Hering, Mr. Geer. Wednesday, 9 a. m. (15).

Armstrong, J. R. C.
Bartell.
Beale, R. B.
Beeuwkes, R. K.
Brady, W. B.
Everett.
Frank, E.
Gorsuch.
Haldeman.
Hodges, W. L.
Keidel, F. B.
Kershner.
Spencer.
Stephens, J. C.
Swaine.

Celestial Mechanics: Dr. Poor. Monday, Tuesday, Wednesday, 12 m., Room 34. (1).

Mitchell.

Theory of Least Squares: Dr. Poor. Thursday, 10 a. m., Friday, 1 p. m. (until March 1), Room 34. (9).

Bartell.
Eisenhart.
Hodges, W. L.
Kershner.
McInnes.
Ortmann.
Reese.
Stephens, J. C.
Waidner.

Theoretical Astronomy: Dr. Poor. Wednesday and Thursday, 10 a. m. (after March 1), Room 34. (2).

Eisenhart.
McInnes.

Observatory Work: Dr. Poor and Dr. Dorsey. Daily, 8 p. m. (9).

Eiseland.
Eisenhart.
James, G. O.
McInnes.
Mendenhall.
Mitchell.
Penniman.
Saunders, F. A.
Stuart, T.

Descriptive Astronomy: (*Undergraduate Elective*): Dr. Poor., Monday, 9 a. m., Tuesday, 10 a. m., Room 34. (2).

Duffy.
Palmer, J. H.

Laboratory Work: Professor Rowland, Dr. Duncan, Dr. Ames, Mr. Hering, Mr. Geer, Dr. Bliss, Dr. Dorsey. Daily, 9 a. m. to 5 p. m. (89).

Abercrombie.
Altvater.
Armstrong, J. R. C.
Bartell.
Beale, R. B.
Beeuwkes, R. K.
Berkeley.
Bestor.
Blanchard.
Bouchelle.
Brady, W. B.
Breed.
Bruce.
Case.
Cooper.
Donaldson.
Douglas.
Earhart.
Edmunds.
Eiseland.
Eisenhart.
Everett.
Fitzgerald.
Foutz.
Francis, I. H.
Frank, E.
Geraghty.
Glaser.
Gorsuch.
Greene, C. W.
Haldeman.
Harrison, C. N.
Haulenbeek.
Herrick.
Hodges, W. L.
Horn.
Howard.
Huff.
James, G. O.
James, R.
Judge.
Keidel, F. B.
Kershner.
L'Engle.
Liddell.
Lucke.
Mackall.
Martin.
McAll.
McInnes.
Meisenhelder.
Mendenhall.
Meyer.
Mitchell.
Morrison.
Ortmann.
Pender.
Penniman.
Potts.
Reese, H. M.
Remsen, C. M.
Rhoads.
Robinson, G. C.
Rogers.
Rothermel.
Rous.
Routh.
Saunders, F. A.
Schenck.
Seth.
Simmons.
Smith, F. W.
Smith, S. P.
Spencer.
Stephens, J. C.
Straus.
Stuart, T.
Swaine.
Taneyhill.
Turnbull.
Ver Planck.
Waidner.
Whitehead.
Whitten.
Wight.
Williams, D.
Winslow.
Winston.
Young.

Chemistry. (138 Students).

Classes meet in the Chemical Laboratory, unless otherwise stated.

Organic Chemistry: (*For Graduate Students*): Professor Remsen. Daily, except Monday, 9 a. m. (41).

Arbuckle.
Berkeley.
Bird.
Black.
Blanchard.
Byers.
Canter.
Case.
Caspari.
Chamberlain.
Cook, C. G.
Crane.
Douglas.
Fraps.
Garner.
Hancock.
Holmes.
Horn.
Howard.
Humphreys.
Jones, W. A.
King, S. H.
Lawson.
Mattern.
Nakaseko.
Ota.
Patterson.
Potts.
Reid, E. E.
Russell.
Ryland.
Scott.
Simmons.
Smith, E. S.
Suppan.
Turner.
Waters.
Weedon.
Whitten.
Wilson, F. D.
Winston.

Journal Meeting: Professor Remsen. Saturday, 9–10.30 a. m. (44). The instructors in Chemistry and the following students:

Arbuckle.
Berkeley.
Black.
Blanchard.
Byers.
Canter.
Case.
Caspari.
Chamberlain.
Cook, C. G.
Crane.
Douglas.
Fraps.
Garner.
Holmes.
Horn.
Howard.
Humphreys.
Jones, W. A.
King, S. H.
Lawson.
Mattern.
Nakaseko.
Ota.
Reid, E. E.
Russell.
Ryland.
Scott.
Simmons.
Smith, E. S.
Suppan.
Turner.
Waters.
Weedon.
Whitten.
Wilson, F. D.
Winston.

Inorganic and Analytical Chemistry: (*For Graduate Stude* Professor Morse. Monday, 9 a. m. (30).

Arbuckle.
Berkeley.
Black.
Blanchard.
Byers.
Canter.
Case.
Caspari.
Cook, C. G.
Crane.
Douglas.
Horn.
Howard.
Humphreys.
Jones, W. A.
King, S. H.
Mattern.
Ota.
Patterson.
Russell.
Ryland.
Scott.
Simmons.
Smith, E. S.
Turner.
Walden.
Waters.
Weedon.
Whitten.
Wilson, F.

Special Course in Physical Chemistry: Dr. H. C. Jo Thursday and Friday, 12 m. (23).

Bartell.
Beeuwkes, R. K.
Berkeley.
Brady, W. B.
Byers.
Caspari.
Everett.
Frank, E.
Greene, C. W.
Haldeman.
Hancock.
Howard.
Keidel, F. B.
King, S. H.
Ortmann.
Ota.
Reese, H. M.
Stephens, J. C.
Suppan.
Swaine.
Waters.
Whitten.
Wilson, F.

Organic Chemistry: (*Major Course*): Professor Morse. D except Monday, 9 a. m. (32).

Bouchelle.
Breed.
Bruce.
Cook, H. W.
Cooper.
Flinn.
Geraghty.
Greenbaum.
Haskell.
Herrick.
Hirshberg.
Huff.
Jungbluth, M.
Keidel, A.
King, T. H.
Lazenby.
L'Engle.
Liddell.
Martin.
McAll.
Morgan.
Remsen, C. M.
Robinson, G. C.
Rogers.
Smith, R. M
Smith, W.
Taveau.
Thomas, R.
Tobin.
Werber.
Williams,
Wright, A.

General Chemistry: (*Minor Course*): Professor Renouf and Randall. Daily, except Monday, 9 a. m., Hopkins Hall. (48).

Altvater.
Baetjer, H.
Brady, J. H.
Brent.
Brooks, C. E.
Clarke, G. M.
Cleaver.
Clunet.
Crummer.
Dieffenbach.
Donaldson.
Downes.
Fosnocht.
Foster, F.
Foutz.
Francis, I. H.
French.
Gaddess.
Glaser.
Gminder.
Gordon.
Grimes.
Hubner.
Hyde.
James, R.
Jones, T. D.
Jungbluth, K.
Levering.
McIntosh.
Miller, R. D.
Mullen.
Murkland.
Powell.
Robinson, E. A.
Ross.
Rous.
Smith, F.
Smith, S. P.
Smull.
Spilman.
Stein, L. D.
Stewart, W.
Taneyhill.
Ulman.
White.
Winslow.
Wirt.
Wright, H.

Laboratory Work: Professor Remsen, Professor Morse, Profe Renouf, Dr. Randall, Dr. Gilpin, Dr. H. C. Jones, Dr. Re Daily, 9 a. m. to 5 p. m. (127).

Arbuckle.
Altvater.
Baetjer, H.
Berkeley.
Bird.
Black.
Blanchard.
Bouchelle.
Brady, J. H.
Breed.
Brent.
Brooks, C. E.
Bruce.
Bruns.
Byers.
Canter.
Case.
Caspari.
Chamberlain.
Clarke, G. M.
Cleaver.
Clunet.
Cook, C. G.
Cook, H. W.
Cooper.
Crane.
Crummer.
Dieffenbach.
Donaldson.
Douglas.
Downes.
Fischer, J. S.
Flinn.
Fosnocht.
Foster, F.
Foutz.
Francis, I. H.
Fraps.
French.
Gaddess.
Garner.
Geraghty.
Glaser.
Gminder.
Gordon.
Greenbaum.
Grimes.
Hancock.
Haskell.
Herrick.
Hirshberg.
Holmes.
Horn.
Howard.
Hubner.
Huff.
Humphreys.
Hyde.
James, R.
Jones, T. D.
Jones, W. A.
Jungbluth, K.
Jungbluth, M.
Keidel, A.
King, S. H.
King, T. H.
Lawson.
Lazenby.
L'Engle.
Levering.
Liddell.
Martin.
Mattern.
McAll.
McIntosh.
Miller, R. D.
Morgan.
Mullen.
Murkland.
Nakaseko.
Ota.
Patterson.
Potts.
Powell.
Reese, H. M.
Reid, E. E.
Remsen, C. M.
Robinson, E. A.
Robinson, G. C.
Rogers.
Ross.
Rous.
Russell.
Ryland.
Scott.
Simmons.
Smith, E. S.
Smith, F.
Smith, R.
Smith, S. P
Smith, W.
Smull.
Spilman.
Stein, L. D.
Stewart, W.
Suppan.
Surface.
Taneyhill.
Taveau.
Thomas, R.
Tobin.
Turner.
Ulman.
Walden.
Waters.
Weedon.
Werber.
White.
Whitten.
Williams,
Wilson, F.
Winslow.
Winston.
Wirt.
Wright, A.
Wright, F.
Wright, H.

Geology. (34 Students).

Class meets in the Geological Laboratory.

General Geology: Professor Clark and Dr. Shattuck. Lect daily, except Friday, 12 m.; laboratory work, Wednesday, 2–5 p. m. (

Cator.
Cleaver.
Coker.
Fischer, J. S.
Fraps.
Hall, C. M.
Lehr.
Robinson, G. C.
Rowe.
Ryland.
Stein, L. D.
Surface.
Taveau.
Thomas, R.
Turner.
Wright, F.

Structural Geology: Mr. Willis. Tuesday and Thursday, 4 p March 1 to May 15. (13).

Abbe.
Cator.
Cleaver.
Coker.
Glenn.
Hall, C. M.
Hartzell.
Leonard.
McLaughlin.
O'Harra.
Rowe.
Surface.
Wright, F.

Historical Geology: Professor Clark. Tuesday and Wednes 9 a. m. (10).

Abbe.
Glenn.
Hall, C. M.
Hartzell.
Leonard.
McLaughlin.
O'Harra.
Reese, A. M.
Surface.
Wright, F.

Paleontology: (*Laboratory Work*): Professor CLARK and Dr. SHATTUCK. Daily, 9 a. m. to 5 p. m. (11).

Abbe.
Cleaver.
Glenn.
Hall, C. M.
Hartzell.
Leonard.
McLaughlin.
O'Harra.
Reese, A. M.
Rowe.
Surface.

Geological Physics: Dr. REID. Monday and Thursday, 9 a. m. (6).

Abbe.
Hartzell.
Glenn.
Leonard.
McLaughlin.
O'Harra.

Geological Physics: (*Laboratory Work*): Dr. REID. Daily, 9 a. m. to 5 p. m. (4).

Abbe.
Glenn.
Leonard.
McLaughlin.

Petrography: Dr. MATHEWS. Friday, 11 a. m. (9).

Abbe.
Glenn.
Hall, C. M.
Hartzell.
Leonard.
McLaughlin.
O'Harra.
Rowe.
Surface.

Petrography: (*Laboratory Work*): Dr. MATHEWS. Daily, 9 a. m. to 5 p. m. (10).

Abbe.
Cleaver.
Glenn.
Hall, C. M.
Hartzell.
Leonard.
McLaughlin.
O'Harra.
Rowe.
Surface.

Mineralogy: Dr. MATHEWS. Lectures, daily, except Friday, 11 a. m.; laboratory work, Monday, 2–5 p. m.; excursions, Saturdays. (19).

Black.
Caspari.
Cleaver.
Glenn.
Hall, C. M.
Hancock.
Hartzell.
Holmes.
Humphreys.
Leonard.
McLaughlin.
Patterson.
Rowe.
Scott.
Surface.
Washburn.
Weedon.
Wilson, F. D.
Wright, F. B.

Map Drawing: Mr. GEER. Afternoons, Front Building, Room 9. (7).

Cleaver.
Hall, C. M.
Hartzell.
Leonard.
McLaughlin.
Rowe.
Surface.

Journal Club: Professor CLARK, Dr. REID, Dr. MATHEWS. Saturday, 9 a. m. (14).

Abbe.
Bibbins.
Cleaver.
Fassig.
Glenn.
Hall, C. M.
Hartzell.
Leonard.
McLaughlin.
O'Harra.
Rowe.
Shattuck.
Surface.
Wright, F. B.

Biology. (114 Students).

Classes meet in the Biological Laboratory.

Advanced Zoology: Professor BROOKS. Daily, 10 a. m. to 5 p. m. (5).

Berger.
Drew.
Grave.
Lefevre.
Reese, A. M.

Zoological Journal Club: Professor BROOKS and Dr. ANDREWS. Friday, 11 a. m. (14).

Barton.
Berger.
Coker.
Drew.
Grave.
Greene, C. W.
Harrison, R. G.
Howe.
Johnson, D. S.
Knower.
Lefevre.
Metcalf.
Reese, A. M.
Sudler.

Zoology: (*Undergraduate Elective*): Dr. ANDREWS. Monday, 2–5 p. m. (5).

Ferguson.
Lehr.
Myers, S. B.
Ver Planck.
Young.

Physiological Seminary: Professor HOWELL. Wednesday, 5 p. m. (5).

Dreyer.
Greene, C. W.
Herrick.
Howe.
Walden.

Physiological Journal Club: Professor HOWELL. Tuesday, 5 p. m. (5).

Dreyer.
Greene, C. W.
Herrick..
Howe.
Walden.

Animal Physiology: Professor HOWELL. Wednesday, Thursday, and Friday, 12 m. (69).

Graduate Students.

Canter.
Howe.
Herrick.
Mattern.
Nakaseko.
Walden.

Medical Students.

Adler.
Atherton.
Baetjer, F. H.
Baldwin.
Berry.
Bloombergh.
Bosley.
Bunting.
Butler.
Carey.
Chowning.
Comer.
Comstock.
Connor, G. L.
Connor, R.
Drake.
Dutcher.
Fowler, H. A.
Gay.
Ghio.
Graham.
Hall, G. W.
Hamman.
Hastreiter.
Hathaway.
Hitzrot.
Holden, G. R.
Hume.
Johnston, W. B.
Kauffman, B. B.
Kaufman, H. M.
Kimball.
Lamson.
Lewis, D. M.
Long.
Longcope.
Lyle.
Maddren.
Manwaring.
McKeough.
Moore, E. S.
Parker.
Pullen.
Rubel.
Rushmore.
Russ.
Salter.
Simis.
Slemons.
Smith, H. M.
Spratt.
Stein, G.
Steinfeld.
Swett.
Ulrich.
Underhill.
Walker.
Warfield.
Warren, G. W.
Watts.
Wells, E. A.
Wells, M.
Winne.

General Physiology and Vertebrate Histology: (*Major Course*): Dr. DREYER. Daily, except Monday, 9 a. m.; Monday and Tuesday, 2–5 p. m. (8).

Chambers.
Coker.
Cooper.
Dohme.
Howe.
Renouf, V. A.
Scholl.
Wooldridge.

Osteology: (*Minor Course*): Dr. ANDREWS. Monday and Wednesday, 10 a. m., till April 1. (31).

Abbe.
Anderson.
Ballard.
Browne, B. B.
Burrell.
Canter.
Cator.
Coker.
Cooper.
Duffy.
Francis, W. W.
Hirshberg.
Howe.
Jungbluth, M.
Lazenby.
L'Engle.
Mattern.
Meisenhelder.
Miller, F. O.
Nakaseko.
Palmer, E. L.
Purcell.
Reese, A. M.
Rogers.
Rowe.
Smith, R. M.
Stein, L. D.
Sudler.
Thomas, R. H.
Tobin.
Williams, D.

General Biology: (*Minor Course*): Dr. ANDREWS. Thursday and Friday, 10 a. m., 2–5 p. m. (31).

Abbe.
Anderson.
Ballard.
Browne, B. B.
Burrell.
Canter.
Cator.
Coker.
Cooper.
Duffy.
Francis, W. W.
Hirshberg.
Howe.
Jungbluth, M.
Lazenby.
L'Engle.
Mattern.
Meisenhelder.
Miller, F. O.
Nakaseko.
Palmer, E. L.
Purcell.
Rogers.
Rowe.
Smith, R. M.
Stein, L. D.
Sudler.
Thomas, R. H.
Tobin.
Washburn.
Williams, D.

Laboratory Work: Professor BROOKS, Professor HOWELL, Dr. ANDREWS, Dr. DREYER, Dr. LEFEVRE. Daily, 9 a. m.–5 p. m. (110).

Abbe.
Adler.
Anderson.
Atherton.
Baetjer, F. H.
Baldwin.
Ballard.
Berger.
Berry.
Bloombergh.
Bosley.
Browne, B. B.
Bunting.
Burrell.
Butler.
Canter.
Carey.
Cator.
Chambers.
Chowning.
Coker.
Comer.
Comstock.
Connor, G. L.
Connor, R.
Cooper.
Dohme.
Drake.
Drew.
Duffy.
Dutcher.
Ferguson.
Fowler, H. A.
Francis, W. W.
Gay.
Ghio.
Graham.
Grave.
Greene, C. W.
Hall, G. W.
Hamman.
Hastreiter.
Hathaway.
Herrick.
Hirshberg.
Hitzrot.
Holden, G. R.
Howe.
Hume.
Johnson, D. S.
Johnston, W. B.
Jungbluth, M.
Kauffman, B. B.
Kaufman, H. M.
Kimball.
Lamson.
Lazenby.
Lehr.
L'Engle.
Lewis, D. M.
Long.
Longcope.
Lyle.
Maddren.
Manwaring.
Mattern.
McKeough.
Meisenhelder.
Miller, F. O.
Moore, E. S.
Myers, S. B.
Nakaseko.
Palmer, E. L.
Parker.
Pullen.
Purcell.
Reese, A. M.
Renouf, V. A.
Rogers.
Rowe.
Rubel.
Rushmore.
Russ.
Salter.
Scholl.
Simis.
Slemons.
Smith, H. M.
Smith, R. M.
Spratt.
Stein, G.
Stein, L. D.
Steinfeld.
Sudler.
Swett.
Thomas, R. H.
Tobin.
Ulrich.
Underhill.
Ver Planck.
Walden.
Walker.
Warfield.
Warren, G. W.
Watts.
Wells, E. A.
Wells, M.
Williams, D.
Winne.
Woodridge.

Greek. (41 Students).

Classes meet in McCoy Hall.

Greek Seminary: *Plato:* Professor GILDERSLEEVE. Monday and Wednesday, 10 a. m., Room 14. (15).

Eckels.
Foster, H. B.
Foushee.
Hamilton.
Hullihen.
Kern.
Kingsbury.
Little, C. H.
Milden.
Montgomery.
Penick.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Introduction to Plato: Professor GILDERSLEEVE. Thursday, 10 a. m., Room 14. (21).

Basore.
Burgess.
Eckels.
Foster, H. B.
Foushee.
Gill.
Green, E. L.
Hamilton.
Hullihen.
Jones, T. M.
Kern.
Kingsbury.
Little, C. H.
Milden.
Montgomery.
Ness.
Penick.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Homer: Professor GILDERSLEEVE. Friday, 10 a. m., Room 14. (18).

Burgess.
Eckels.
Foster, H. B.
Foushee.
Green, E. L.
Hamilton.
Hullihen.
Kern.
Kingsbury.
Little, C. H.
Milden.
Montgomery.
Ness.
Penick.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Syntax: Professor GILDERSLEEVE. Tuesday, 10 a. m., Room 14. (21).

Basore.
Burgess.
Eckels.
Foster, H. B.
Foushee.
Gill.
Green, E. L.
Hamilton.
Hullihen.
Jones, T. M.
Kern.
Kingsbury.
Little, C. H.
Milden.
Montgomery.
Ness.
Penick.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Aristotle's Nicomachean Ethics: Dr. MILLER. Tuesday and Thursday, 9 a. m., Room 15. (9).

Foster, H. B.
Foushee.
Hamilton.
Kern.
Kingsbury.
Milden.
Montgomery.
Penick.
Sanders, H. N.

Prose Composition: Dr. MILLER. Friday, 9 a. m., Room 19. (4).

Eckels.
Kingsbury.
Montgomery.
Penick.

Elegiac, Iambic, and Melic Poets; Sophocles: (*Major Course*): Dr. SPIEKER. Monday, Tuesday, Wednesday, 12 m., Room 10. (6).

Bogue.
Fisher, F. C.
French.
King, J. H.
Ross.
Spilman.

Homer, *Iliad, xvi and xviii;* ***Euripides:*** (*Minor Course*): Dr. SPIEKER. Tuesday, Wednesday, Thursday, 1 p. m., Room 10. (10).

Anderson.
Burrell.
Chambers.
Eager.
Ewell.
Griffin, J. W.
Purcell.
Ramsay.
Shriver.
Wight.

Herodotus; Prose Composition: Dr. MILLER. Monday, 10 a. m.; Thursday and Friday, 1 p. m., Room 8. (3).

Bernheim.
Constantine.
Snavely, G. E.

Prose Composition: Dr. SPIEKER.

Major Course: Friday, 12 m., Room 10. (6).

Bogue.
Fisher, F. C.
French.
King, J. H.
Ross.
Spilman.

Minor Course: Monday, 1 p. m., Room 10. (10).

Anderson.
Burrell.
Chambers.
Eager.
Ewell.
Griffin, J. W.
Purcell.
Ramsay.
Shriver.
Wight.

Latin. (69 Students).

Classes meet in McCoy Hall.

Latin Seminary: *Plautus and Terence:* Professor WARREN. Tuesday and Friday, 11 a. m., Room 15. (17).

Basore.
Burgess.
Daniel.
Foushee.
Gill.
Glascock.
Hamilton.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Lyon.
Milden.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Latin Inscriptions: Professor WARREN. Thursday, 11 a. m., Room 15. (20).

Basore.
Burgess.
Daniel.
Foster, H. B.
Foushee.
Gill.
Glascock.
Green, E. L.
Hamilton.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Lyon.
Milden.
Sanders, H. N.
Schulz.
Spragins.
Warner.
Wilson, H. L.

Roman Topography: Professor WARREN. Wednesday, 11 a. m., Room 15. (16).

Basore.
Burgess.
Daniel.
Foushee.
Gill.
Hamilton.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Lyon.
Milden.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Journal Club: Professor WARREN. Alternate Thursdays, 12 m., Room 15. (14).

Basore.
Burgess.
Daniel.
Foushee.
Gill.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Milden.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Roman Epigram: (*Lectures*): Professor SMITH. Monday, 11 a. m., Room 15. (19).

Basore.
Burgess.
Daniel.
Eckels.
Foushee.
Gill.
Glascock.
Hamilton.
Hoeing.
Hullihen.
Jones, T. M.
Little, C. H.
Lyon.
Milden.
Penick.
Sanders, H. N.
Schulz.
Spragins.
Warner.

Pro-Seminary: Dr. SMITH. Monday, 9 a. m., Room 15. (6).

Burgess.
Little, C. H.
Lyon.
Schulz.
Spragins.
Warner.

Valerius Flaccus; Statius: (*Undergraduate Elective*): Dr. SMITH. Thursday, 12 m., Friday, 9 a. m., Room 15. (2).

Harry.
Pyle.

Plautus; Terence: (*Major Course*): Dr. SMITH. Wednesday, Thursday, and Friday, 10 a. m., Room 10. (13).

Bogue.
Chambers.
Davidson.
Fisher, F. C.
French.
Gemmill.
Greene, J. D.
Jones, R. H.
Kalb, J. A.
King, J. H.
Ross.
Smith, V. E.
Spilman.

Roman Literature: (*Minor Course*): Dr. SMITH. Tuesday, 9 a. m., Room 11. (15).

Beeuwkes, C. J.
De Grange.
Francis, W. W.
Heyman.
Hill, H. D.
Hill, J. P.
Kaufman, H.
Lindheim.
Loeb.
Marshall, T. H.
Moore, J. S.
Peters.
Schermerhorn.
Stephens, C. G.
Wingert.

Horace: (*Minor Course*): Dr. WILSON. Wednesday, Thursday, Friday, 9 a. m., Room 12. (24).

Anderson.
Beeuwkes, C. J.
Burrell.
Clark, C. T.
De Grange.
Eager.
Ewell.
Francis, W. W.
Griffin, J. W.
Heyman.
Hill, H. D.
Hill, J. P.
Kaufman, H.
Lindheim.
Loeb.
Marshall, T. H.
Moore, J. S.
Peters.
Purcell.
Roulston.
Schermerhorn.
Stephens, C. G.
Wight.
Wingert.

Ovid; Vergil; Prose Composition: Dr. WILSON. Wednesday Thursday, Friday, 10 a. m., Room 8. (10).

Bernheim.
Brady, J. H.
Constantine.
Crummer.
Diggs.
Ember.
Flinn.
Kerr.
Snavely, G. E.
Whitman.

Prose Composition:

Major Course: Dr. SMITH. Monday, 10 a. m., Room 10. (13).

Bogue.
Chambers.
Davidson.
Fisher, F. C.
French.
Gemmill.
Greene, J. D.
Jones, R. H.
Kalb, J. A.
King, J. H.
Ross.
Smith, V. E.
Spilman.

Minor Course: Dr. WILSON. Tuesday, 9 a. m., Room 12. (9).

Anderson.
Burrell.
Clark, C. T.
Eager.
Ewell.
Griffin, J. W.
Purcell.
Roulston.
Wight.

Sanskrit and Comparative Philology. (37 Students).

Classes meet in Room 19, McCoy Hall.

Comparative Philology: (*Lectures on the Science of Language*). Professor BLOOMFIELD. Monday, 4 p. m. (16).

Barnett.
Brush.
Drewry.
Eiesland.
Foster, H. B.
Frank, S. W.
Greenbaum.
Harry, P. W.
Hodges, C. S.
Jones, R. H.
Jones, T. M.
Miller, R. D.
Nitze.
Pyle.
Radcliffe.
Smith, V. E.

Comparative Grammar of the Indo-European Languages: (*Noun-Formation*): Professor BLOOMFIELD. Thursday 4 p. m. (17).

Basore.
Blake.
Burgess.
Eckels.
Foushee.
Green, E. L.
Grimm.
Hamilton.
Jones, T. M.
Kern.
Kingsbury.
Kurrelmeyer, W.
Land.
Milden.
Montgomery.
Ness.
Penick.

Lithuanian Language and Literature: Professor BLOOMFIELD. Tuesday, 4 p. m. (5).

Blake.
Bolling.
Green, E. L.
Kurrelmeyer, W.
Ness.

Vedic Seminary: (*Brāhmaṇas and Upaniṣads*): Professor BLOOMFIELD. Friday, 4 p. m. (9).

Basore.
Blake.
Foushee.
Green, E. L.
Hamilton.
Kern.
Milden.
Ness.
Sanders, H. N.

Introduction to the Language of the Avesta: Mr. NES Thursday, 3 p. m. (2).

Blake.
Grimm.

Advanced Sanskrit: (*Introduction to the Rig-Veda*): Mr. NES Wednesday, 12 m. (7).

Basore.
Blake.
Foushee.
Hamilton.
Kern.
Milden.
Sanders, H. N.

Elementary Sanskrit: Professor BLOOMFIELD. Monday and Fri day, 12 m. (5).

Foster, H. B.
Grimm.
Kurrelmeyer, W.
Schulz.
Spragins.

Oriental Seminary. (28 Students).

Classes meet in the Dillmann Library, McCoy Hall, Room 18.

Critical Interpretation of Selected Psalms on the basi of the Authorized Version: Professor HAUPT. Wednesday 5 p. m. (16).

Caldwell.
Cantey.
Cator.
Grimm.
Hall, C. M.
Heald.
Hirshberg.
Land.
Mahoney.
McPherson.
Paine.
Rothermel.
Rowe.
Sumwalt.
Weaver, C. C.
Wright, F. B.

Biblical Antiquities: (*Religious and Civic Institutions of the Ancie Hebrews*): Dr. JOHNSTON. Friday, 10 a. m. (10).

Caldwell.
Cantey.
Gill.
Grimm.
Lee.
McPherson.
Paine.
Schmeckebier.
Sumwalt.
Weaver, E. E.

Elementary Hebrew: (*Gesenius-Mitchell's Hebrew Grammar; Genesi ed. Baer-Delitzsch*): Professor HAUPT. Wednesday, 3-5 p. m. (9).

Caldwell.
Frank, S. W.
Gardner.
Grimm.
Heald.
Mahoney.
McPherson.
Stearns.
Weaver, E. E.

Hebrew: (*Second Year's Course: Interpretation of the Book of Judges*) Professor HAUPT. Monday, 4 p. m. (12).

Blake.
Caldwell.
Grimm.
Guttmacher.
Land.
Mahoney.
McPherson.
Rosenau.
Schanfarber.
Sumwalt.
Tracy.
Weaver, E. E.

Hebrew Exercises: (*Cursory Reading of the Book of Isaiah*): Di JOHNSTON. Thursday, 9-11 a. m. (3).

Grimm.
Mahoney.
Tracy.

Exercises in Reading Hebrew at Sight: (*Historical Books*): Dr. JOHNSTON. Friday, 12 m. (4).

Blake.
Caldwell.
McPherson.
Sumwalt.

Hebrew Prose Composition: (*Translating from English into Hebrew*): Professor HAUPT. Monday, 3.30 p. m. (12).

Blake.
Caldwell.
Grimm.
Guttmacher.
Land.
Mahoney.
McPherson.
Rosenau.
Schanfarber.
Sumwalt.
Tracy.
Weaver, E. E.

Comparative Hebrew Grammar: Professor HAUPT. Tuesday, 3 p. m. (10).

Blake.
Caldwell.
Grimm.
Guttmacher.
Land.
McPherson.
Rosenau.
Schanfarber.
Sumwalt.
Weaver, E. E.

Hebrew: (*Advanced Course: Critical Interpretation of the Book of Isaiah, Chapters i–xxxix*): Professor HAUPT. Monday, 5 p. m. (12).

Caldwell.
Cantey.
Grimm.
Guttmacher.
Land.
Mahoney.
McPherson.
Rosenau.
Schanfarber.
Sumwalt.
Tracy.
Weaver, E. E.

Critical Interpretation of the Aramaic Portions of the Book of Ezra: Professor HAUPT. Tuesday, 4 p. m. (9).

Caldwell.
Grimm.
Guttmacher.
Land.
McPherson.
Rosenau.
Schanfarber.
Sumwalt.
Weaver, E. E.

Syriac: (*Roediger's Chrestomathy*): Dr. JOHNSTON. Friday, 11 a. m. (2).

Grimm.
Land.

Arabic for Beginners: (*Socin's Grammar*): Dr. JOHNSTON. Wednesday, 10 a. m. (2).

McPherson.
Sumwalt.

Selections from Arabic Geographers: Dr. JOHNSTON. Tuesday, 9–11 a. m. (4).

Grimm.
Guttmacher.
Rosenau.
Schanfarber.

Arabic Prose Composition: (*Translating from English into Arabic*): Professor HAUPT. Monday, 3 p. m. (7).

Blake.
Grimm.
Guttmacher.
Land.
Rosenau.
Schanfarber.
Sumwalt.

Assyrian for Beginners: (*Meissner's Chrestomathy*): Dr. JOHNSTON. Wednesday, 11 a. m. (1).

McPherson.

Assyrian Historical Texts: Dr. JOHNSTON. Tuesday, 11 a. m. (3).

Grimm.
Land.
Sumwalt.

Assyrian Seminary: Professor HAUPT. Tuesday, 5 p. m. (3).

Blake.
Grimm.
Land.

English. (127 Students).

Classes meet in McCoy Hall.

English Seminary: (*The complete works of Chaucer*): Professor BRIGHT. Tuesday and Thursday, 3–5 p. m., Room 4. (12).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Hagen.
Heald.
Huguenin.
Parham.
West, H. S.
Wharey.

English Versification: (*Lectures*): Professor BRIGHT. Wednesday, 4 p. m. (13).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Hagen.
Heald.
Huguenin.
Miles.
Parham.
West, H. S.
Wharey.

Plays of Shakespeare: Professor BRIGHT. Tuesday and Thursday, 12 m., Room 12. (13).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Hagen.
Heald.
Huguenin.
Miles.
Parham.
West, H. S.
Wharey.

Journal Meeting: Professor BRIGHT. Alternate Fridays, 4–6 p. m., Room 4. (14).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Hagen.
Heald.
Huguenin.
Miles.
Parham.
Shipley.
West, H. S.
Wharey.

Anglo-Saxon: (*Major Course*): Professor BRIGHT. Monday and Wednesday, 12 m., Room 8. (3).

Browne, B. B.
Miles.
Stidman.

The English Drama from Dryden to Sheridan: (*Lectures*): Professor BROWNE. Wednesday, 11 a. m., Room 8. (12).

Barr.
Becker.
Brown, G. D.
Campbell, K.
Farr.
Griffin, N. E.
Heald.
Huguenin.
Miles.
Parham.
West, H. S.
Wharey.

Elizabethan Literature; Early Scottish Poets: (*Major Course*): Professor BROWNE. Tuesday and Friday, 12 m., Room 8. (2).

Browne B. B.
Stidman.

Early English Texts; English Literature: (*Minor Course*): Professor BROWNE. Daily, except Friday, 1 p. m., Room 6. (13).

Ballard.
Clunet.
Duffy.
Greenbaum.
Hanna.
Harry, P. W.
Harwood.
Hill, H. D.
Hubner.
Lazenby.
Murkland.
Peters.
Smith, V. E.

English Literature: (*Undergraduate Elective*): Professor GREENE. Thursday, 12 m., Friday, 1 p. m., Room 9. (9).

Ballard.
Hammond.
Jones, R. H.
Miller, F. O.
Palmer, J. H.
Ramsay.
Renouf, V. A.
Seth.
Stearns.

English Literature: (*Required Undergraduate Course*): Professor GREENE. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., Room 11. (40).

Bogue.
Brady, J. H.
Bruce.
Chambers.
Crummer.
Downes.
Fisher, F. C.
Fooks.
French.
Gaddess.
Gemmill.
Grimes.
Guggenheimer.
Hanna.
Haskell.
Jones, T. D.
Joyner.
Jungbluth, K.
Jungbluth, M.
Kalb, J. A.
Keidel, A.
King, J. H.
Knapp.
Krager.
Lazenby.
Morgan.
Mullen.
Ramsay.
Remsen, C. M.
Reymann.
Robinson, G. C.
Ross.
Smull.
Spilman.
Talty.
Taveau.
Thomas, R. H.
Verplanck.
Werber.
Whitman.

Rhetoric and English Composition: Professor GREENE. Monday, Tuesday, Wednesday, 12 m., Room 11. (57).

Abercrombie.
Altvater.
Anderson.
Baetjer, H.
Beeuwkes, C. J.
Bernheim.
Bouchelle.
Brady, J. H.
Breed.
Brooks, C. E.
Burrell.
Clark, C. T.
De Grange.
Diggs.
Donaldson.
Eager.
Ewell.
Foster, F.
Foutz.
Francis, I. H.
Glaser.
Gminder.
Greene, J. D.
Griffin, J. W.
Heyman.
Hill, H. D.
Hill, J. P.
Hyde.
Kaufman, H.
Kerr.
King, T. H.
Liddell.
Lindheim.
Loeb.
Mackall.
Marshall, T. H.
McAll.
Moore, J. S.
Morrison.
Powell.
Purcell.
Roulston.
Rous.
Routh.
Schermerhorn.
Shriver.
Smith, S. P.
Smith, W. L.
Stephens, C. G.
Taneyhill.
Verplanck.
White.
Wight.
Wingert.
Winslow.
Wirt.
Wright, H. C.

German. (118 Students).

Classes meet in McCoy Hall.

(*Advanced Courses.*)

German Seminary: *Nibelungen Lied:* Professor WOOD. Tuesday, Thursday, and Friday, 9 a. m., Room 4. (10.)

Blake.
Brown, G. D.
Farr.
Glascock.
Hagen.
Heald.
Hofmann.
Kurrelmeyer, W.
Lyon.
Wharey.

Germanic Society: Professor WOOD. Fortnightly, Friday, 8 p. m. (18).

Becker.
Blake.
Brown, G. D.
Campbell, K.
Farr.
Glascock.
Hagen.
Heald.
Hofmann.
Hullihen.
Jones, T. M.
Kurrelmeyer, W.
Little, C. H.
Lyon.
Ness.
Nitze.
Wharey.
Wilkens.

Gothic: Professor WOOD. Wednesday and Friday, 10 a. m., Room 4. (9).

Blake.
Eiesland.
Glascock.
Hagen.
Heald.
Lyon.
Parham.
West, H. S.
Wharey.

Schiller's Dramas: Professor WOOD. Wednesday, 9 a. m., Room 4. (9).

Glascock.
Hofmann.
Hullihen.
Kurrelmeyer, W.
Little, C. H.
Lyon.
Miles.
Nitze.
Wharey.

German Literature in the XI Century: Dr. VOS. Monday and Thursday, 10 a. m., Room 12. (3).

Hofmann.
Kurrelmeyer, W.
Ness.

Modern Dutch: Dr. VOS. Monday and Wednesday, 11 a. m., Room 6. (3).

Blake.
Hofmann.
Kurrelmeyer, W.

(*Major Course.*)

Scherer, *History of German Literature:* Dr. VOS. Wednesday. ***Goethe,*** *Faust:* Professor WOOD. Monday and Thursday. ***Prose Composition:*** Professor WOOD and Dr. BAKER. Friday, 10 a. m., Room 6. (7).

Baetjer, H.
Farr.
Haskell.
Keidel, A.
Miles.
Powell.
Smull.

(*Minor Course A.*)

Prose Composition: Professor WOOD. Monday. ***Prose Readings and Classics:*** Dr. VOS. Tuesday, Thursday, and Friday, 11 a. m., Room 11. (26).

Bouchelle.
Breed.
De Grange.
Eager.
Ember.
Flinn.
Foster, F.
Greene, J. D.
Heyman.
Hill, H. D.
Hill, J. P.
Hyde, E. P.
King, J. H.
King, T. H.
Lazenby.
Loeb.
Mackall.
Peters.
Roulston.
Rous.
Routh.
Schermerhorn.
Stephens, C. G.
Tobin.
Turnbull.
Winslow.

(*Minor Course B.*)

Dr. Baker. Daily, except Wednesday, 11 a. m., Room 8. (24).

Brooks, C. E.
Clark, C. T.
Ewell.
Fisher, F. C.
Ford.
Geraghty.
Griffin, J. W.
Kaufman, H.
Kerr.
Lindheim.
Marshall, T. H.
McAll.
Moore, J. S.
Motley.
Murkland.
Ramsay.
Rogers.
Shriver.
Smith, S. P.
Smith, W. L.
White.
Wingert.
Wirt.
Wright, H. C.

Elementary German: Dr. Vos. Tuesday, Wednesday, and Friday, 9 a. m., Room 6. (7).

Abercrombie.
Bernheim.
Constantine.
Diggs.
Morrison.
Snavely, G. E.
Whitman.

German Conversation: Dr. Hofmann. Tuesday, 5 p. m., Room 8. (9).

Davidson.
Fosnocht.
Francis, W. W.
Frank, S. W.
Lyon.
Meisenhelder.
Miles.
Williams, D.
Wilson, H. L.

(*Elective Courses.*)

Contemporary Readings: Dr. Baker. Monday, 9 a. m., Tuesday, 10 a. m., Room 8. (16).

Browne, B. B.
Clunet.
Cook, H. W.
Dieffenbach.
Fischer, J. S.
Fosnocht.
Francis, W. W.
Frank, S. W.
Gordon.
Greenbaum.
Hammond.
Hodges, C. S.
Kalb, C. W.
Smith, F. M.
Smith, R. M.
Stidman.

Scientific Readings: Dr. Baker. Thursday, 12 m., Friday, 1 p. m., Room 6. (6).

Dohme.
Hirshberg.
Kershner.
Scholl.
Straus.
Whitehead.

Scientific German: (*For Graduate Students*): Dr. Hofmann. Monday and Thursday, 5 p. m., Room 8. (12).

Black.
Canter.
Chamberlain.
Cooper.
Howe.
Mattern.
Meisenhelder.
Potts.
Reese, H. M.
Rowe.
Walden.
Williams, D.

Romance Languages. (76 Students).

Classes meet in McCoy Hall.

(*Advanced Courses.*)

Romance Seminary: *Fables of Marie de France:* Professor Elliott, Tuesday, 11 a. m.–1 p. m., Room 2. (9).

Baxter.
Brownell, G. G.
Brush.
Frein.
Keidel, G. C.
Kuersteiner.
Nitze.
Shaw.
Wilson, R. H.

French Dialects: Professor Elliott. Monday, 11 a. m., Room 2. (6).

Baxter.
Frein.
Holden
Kuersteiner.
Shaw.
Wilson, R. H.

French Philology: Dr. Armstrong. Monday, 10 a. m., Wednesday, 9 a. m., Friday, 11 a. m., Room 2. (8).

Baxter
Brush.
Frein.
Hagen.
Holden.
Kuersteiner.
Parham.
Teillard.

Old French Readings: Dr. Armstrong. Monday and Wednesday, 3 p. m., Room 2. (8).

Brush.
Farr.
Glascock.
Hagen.
Lyon.
Parham.
Shaw.
Wharey.

French Criticism: Dr. Ogden. Thursday, 12 m., Room 2. (7).

Brownell, G. G.
Frein.
Glascock.
Kuersteiner.
Lyon.
Nitze.
Shaw.

Phonetics and French Pronunciation: Dr. Rambeau. Tuesday, 10 a. m., Room 7. (5).

Glascock.
Hagen.
Lyon.
West, H. S.
Wharey.

Romans d'Aventure: Dr. F. M. Warren. Monday, 12 m., Tuesday, Wednesday, Thursday, 11 a. m., Friday, 9 a. m., Room 2. (During February). (10).

Baxter.
Brownell, G. G.
Brush.
Frein.
Kuersteiner.
Keidel, G. C.
Nitze.
Ogden.
Shaw.
Wilson, R. H.

The Romantic School of French Literature: Dr. F. M. Warren. Monday, Wednesday, Friday, 5 p. m., Donovan Room; Tuesday, 12 m., Room 2. (During February). (13).

Armstrong, E. C.
Baxter.
Brownell, G. G.
Brush.
Frein.
Glascock.
Kuersteiner.
Keidel, G. C.
Lyon.
Nitze.
Ogden.
Shaw.
Wilson, R. H.

Popular Latin: Professor Elliott. Monday, 12 m., Room 2. (6).

Brush.
Frein.
Holden.
Kuersteiner.
Shaw.
Wilson, R. H.

Dante: Professor Elliott. Wednesday, 12 m., Room 2. (2).

Kuersteiner.
Wilson, R. H.

Spanish Seminary: Dr. Marden. Thursday, 10 a. m., Room 2. (2).

Brownell, G. G.
Kuersteiner.

Spanish Epic Poetry: Dr. Marden. Friday, 12 m., Room 2.

Brownell, G. G.
Kuersteiner.
Shaw.

Old Spanish Readings: Dr. Marden. Monday, 10 a. m., Roo (3).

Brownell, G. G.
Holden.
Kuersteiner.

Spanish Philology: Dr. Marden. Wednesday and Friday, 10 a Room 2. (2).

Brownell, G. G.
Kuersteiner.

Romance Club: Professor Elliott. Wednesday, 11 a. m., Roo (12).

Armstrong, E. C.
Baxter.
Brownell, G. G.
Brush.
Frein.
Kuersteiner.
Keidel, G. C.
Marden.
Nitze.
Ogden.
Shaw.
Wilson, R.

(*Undergraduate Courses.*)

Italian: (*Minor Course*): Dr. Rambeau. Daily, except Mon 9 a. m., Room 7. (2).

Jones, A. D.
Kurrelmeyer, H.

Italian: (*Undergraduate Elective*): Mr. Baxter. Monday, 9 a Thursday, 12 m., Room 6. (2).

Fitzgerald.
Jones, A. D.

Spanish: (*Minor Course*): Dr. Marden. Daily, except Mon 9 a. m., Room 8. (5).

Davidson.
Guggenheimer.
Joyner.
Krager.
Reymann.

Spanish: (*Undergraduate Elective*): Mr. Kuersteiner. Mon 9 a. m., Thursday, 12 m., Room 4. (1).

Clarke, G. M.

French: (*Major Course*): Dr. Rambeau. Daily, except Tue 10 a. m., Room 7. (6).

Dohme.
Grimes.
Morgan.
Mullen.
Stidman.
Wharey.

French: (*Minor Course A*): Dr. Rambeau. Daily, except Thur 12 m., Room 7. (18).

Crummer.
Davidson.
Ember.
Fosnocht.
Frank, S. W.
Hagen.
Harry, P. W.
Harwood.
Jones, R. H.
Kalb, J. A.
Keidel, A.
Kurrelmeyer, H.
Miller, R. D.
Smull.
Tobin.
Werber.
Whitman.
Wright, H.

French: (*Minor Course B*): Dr. Ogden. Daily, except Thur 12 m., Room 6. (15).

Benton.
Bruce.
Fooks.
Gorsuch.
Hodges, C. S.
Knapp.
Pyle.
Ramsay.
Remsen, C. M.
Smith, V. E.
Snavely, C.
Stearns.
Stephens,
Walden.
Weaver, C.

French: (*Undergraduate Elective*): Dr. Armstrong. Monday, 9 Room 10; Friday, 1 p. m., Room 2. (11).

Armstrong, J. R. C.
Bestor.
Brent.
Fowler, L. H.
Kennard.
Lehr.
McIntosh.
Miles.
Robinson, E. A.
Stewart, W
Turnbull.

French: (*Elements*): Mr. Kuersteiner. Tuesday, Thursday, Friday, 9 a. m., Room 10. (3).

Greene, J. D.
Homer.
Meisenhelder.

History, Economics, and Politics. (124 Student

Classes meet in McCoy Hall.

Historical Seminary: Professor Adams. Fortnightly, Fri 8–10 p. m., Room 25. (26).

Adams, T. S.
Barnett.
Benton.
Brander.
Brough.
Campbell, H.
Cantey.
Drewry.
Ewing.
Garrett, R.
Green, E. L.
Kaye.
Latané.
Lee.
Motley.
Myers, W. S.
Paine.
Radcliffe.
Schmeckebier.
Schunck.
Sioussat.
Smith, E.
Snavely, C.
Sommervil
Thom.
Weaver, C.

History of Civilization: (*Major Course*): Professor Adams. day and Tuesday, 11 a. m., Room 24. (36).

Barnett.
Bogue.
Brander.
Campbell, H.
Davidson.
Downes.
Drewry.
Fooks.
Frank, S. W.
Gaddess.
Gardner.
Gemmill.
Glaser.
Grimes.
Guggenheimer.
Hanna.
Harwood.
Haskell.
Jones, T. D.
Joyner.
Jungbluth, K.
Kalb, J. A.
Knapp.
Krager.
Kurrelmeyer, H.
Levering.
Morgan.
Mullen.
Myers, W.
Paine.
Rayner.
Reymann.
Rickey.
Taneyhill.
West, H. S
Willms.

Roman Politics: Professor Adams. Wednesday and Thursda a. m., Room 25. (22).

Barnett.
Benton.
Brander.
Campbell, H.
Cantey.
Dennis.
Drewry.
Ewing.
Garrett, R.
Green, E. L.
Kaye.
Lee.
Motley.
Myers, W. S.
Radcliffe.
Schloegel.
Schmeckebier.
Sioussat.
Snavely, C
Sommervil
Thom.
Weaver, C.

Nineteenth Century: Professor Adams. Friday, 11 a. m., Room 25. (24).

Barnett.
Benton.
Caldwell.
Campbell, H.
Cantey.
Dennis.
Drewry.
Ewing.
Garrett, R.
Green, E. L.
Kaye.
Lee.
Motley.
Myers, W. S.
Paine.
Radcliffe.
Schmeckebier.
Sioussat.
Snavely, C.
Sommerville.
Thom.
Weaver, C. C.
West, H. S.
Willms.

Historical Method: Dr. Vincent. Tuesday and Thursday, 10 a. m., Room 23. (19).

Adams, T. S.
Barnett.
Benton.
Campbell, H.
Cantey.
Dennis.
Drewry.
Ewing.
Kaye.
Motley.
Radcliffe.
Schloegel.
Schmeckebier.
Schunck.
Sioussat.
Snavely, C.
Sommerville.
Thom.
Weaver, C. C.

Historical Conference: Dr. Vincent. Fortnightly, Saturday, 8–10 p. m. (8).

Benton.
Kaye.
Motley.
Schmeckebier.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

European History: (*Major Course*): Dr. Vincent. Thursday and Friday, 11 a. m., Room 24. (26).

Bogue.
Davidson.
Downes.
Fooks.
Frank, S. W.
Gaddess.
Gemmill.
Glaser.
Grimes.
Guggenheimer.
Hanna.
Harwood.
Haskell.
Jones, T. D.
Joyner.
Jungbluth, K.
Kalb, J. A.
Knapp.
Krager.
Kurrelmeyer, H.
Levering.
Morgan.
Mullen.
Reymann.
Rickey.
Taneyhill.

Historical Politics: (*History-Economics*): Dr. Vincent. Monday and Wednesday, 10 a. m., Room 23. (25).

Bestor.
Clunet.
Ferguson.
Fischer, J. S.
Fosnocht.
Fowler, L. H.
Greenbaum.
Harry, P. W.
Hodges, C. S.
Homer.
Kurrelmeyer, H.
Lucke.
Murkland.
Myers, S. B.
Pender.
Pyle.
Renouf, V. A.
Scholl.
Straus.
Taveau.
Ver Planck.
Werber.
Wooldridge.
Wright, A.
Young.

Southern Economic History: Dr. Ballagh. Thursday, 1 p. m., Room 20. (7).

Barnett.
Drewry.
Radcliffe.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

Municipal Government: Dr. Ballagh. Thursday, 12 m., Room 20. (9).

Adams, T. S.
Benton.
Cantey.
Schloegel.
Schmeckebier.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

Conference on Southern History: Dr. Ballagh. Tuesday, 9 a. m., Room 20. (7).

Drewry.
Kaye.
Motley.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

General History Examinations: Dr. Ballagh. Friday, 9 a. m., Room 20. (2).

Kaye.
Lee.

Greek and Roman History: (*Minor Course*): Dr. Ballagh. Daily, except Tuesday, 10 a. m., Room 20. (15).

Beeuwkes, C. J.
Clark, C. T.
De Grange.
Heyman.
Hill, J. P.
Lindheim.
Loeb.
Marshall, T. H.
Moore, J. S.
Peters.
Roulston.
Schermerhorn.
Shriver.
Stephens, C. G.
Wingert.

Economic Seminary: Dr. Sherwood and Dr. Hollander. Thursday, 4–6 p. m., Room 21. (7).

Adams, T. S.
Barnett.
Brough.
Campbell, H.
Myers, W. S.
Schloegel.
Smith, E. A.

Theory of Credit: Dr. Sherwood. Thursday and Friday, 9 a. m., Room 24. (18).

Adams, T. S.
Barnett.
Benton.
Brough.
Campbell, H.
Cantey.
Drewry.
Garrett, R.
Motley.
Myers, W. S.
Paine.
Radcliffe.
Schloegel.
Schmeckebier.
Sioussat.
Smith, E. A.
Snavely, C.
Sommerville.

Economic Sociology: Dr. Sherwood. Monday, 9 a. m., Room 24. (14).

Adams, T. S.
Barnett.
Brander.
Brough.
Campbell, H.
Cantey.
Drewry.
Kaye.
Motley.
Paine.
Radcliffe.
Schmeckebier.
Smith, E. A.
Sommerville.

Economic System of Ricardo: Dr. Hollander. Tuesday and Wednesday, 9 a. m., Room 24. (8).

Adams, T. S.
Barnett.
Benton.
Brough.
Campbell, H.
Radcliffe.
Schloegel.
Smith, E. A.

Current Congressional History: Dr. Hollander. Thursday, 3 p. m., Room 21. (12).

Adams, T. S.
Barnett.
Benton.
Brough.
Campbell, H.
Drewry.
Garrett, R.
Myers, W. S.
Schmeckebier.
Sioussat.
Sommerville.
Thom.

Mathematical Economics: Dr. Moore. Monday, Wednesday, Friday, 10 a. m., Room 21. [12 lectures]. (9).

Adams, T. S.
Barnett.
Brough.
Campbell, H.
Myers, W. S.
Paine.
Schloegel.
Smith, E. A.
Radcliffe.

Recent Economic Theory: (*Undergraduate Elective*): Dr. Sherwood. Thursday, 12 m., Friday, 1 p. m., Room 21. (8).

Barnett.
Drewry.
Garrett, R.
Morgan.
Myers, S. B.
Myers, W. S.
Schloegel.
Ulman.

International Trade: (*Minor Course*): Dr. Hollander. Monday and Wednesday, 10 a. m., Room 24. (22).

Cook, H. W.
Diffenbach.
Downes.
Fooks.
Frank, S. W.
Gaddess.
Guggenheimer.
Hammond.
Hanna.
Jones, T. D.
Joyner.
Jungbluth, K.
Kaufman, H.
Kennard.
Knapp.
Krager.
Levering.
Reymann.
Rickey.
Stearns.
Talty.
Willms.

Money and Banking: (*Minor Course and History-Economics*): Dr. Hollander. Thursday and Friday, 10 a. m., Room 24. (51).

Bestor.
Clunet.
Cook, H. W.
Dieffenbach.
Dohme.
Downes.
Ferguson.
Fischer, J. S.
Fitzgerald.
Fooks.
Fosnocht.
Fowler, L. H.
Frank, S. W.
Gaddess.
Greenbaum.
Guggenheimer.
Hammond.
Hanna.
Harry, P. W.
Harwood.
Hodges, C. S.
Homer.
Jones, T. D.
Joyner.
Jungbluth, K.
Kaufman, H.
Kennard.
Knapp.
Krager.
Kurrelmeyer, H.
Lehr.
Levering.
Lucke.
Miller, R. D.
Murkland.
Pender.
Pyle.
Rayner.
Renouf.
Reymann.
Rickey.
Scholl.
Smith, E. A.
Stearns.
Straus.
Talty.
Taveau.
Werber.
Wooldridge.
Wright, A.
Young.

American Public Law: Dr. Willoughby. Monday and Tuesday, 11 a. m., Room 20. (12).

Adams, T. S.
Benton.
Cantey.
Ewing.
Kaye.
Radcliffe.
Schloegel.
Schmeckebier.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

History of Political Philosophy: Dr. Willoughby. Monday and Tuesday, 12 m., Room 20. (15).

Barnett.
Campbell, H.
Cantey.
Drewry.
Ensor.
Ewing.
Garrett, J. W.
Garrett, R.
Kaye.
Myers, W. S.
Paine.
Schloegel.
Sioussat.
Sommerville.
Thom.

Political Conference: Dr. Willoughby. Fortnightly, Friday, 4–6 p. m., Room 20. (6).

Adams, T. S.
Kaye.
Sioussat.
Sommerville.
Thom.
Weaver, C. C.

American Political and Constitutional History: Dr. Steiner. Wednesday and Friday, 12 m., Room 24. (28).

Brent.
Clarke, G. M.
Ferguson.
Fowler, L. H.
Garrett, R.
Gemmill.
Gordon.
Hammond.
Hubner.
Kalb, C. W.
Kaye.
Kennard.
McIntosh.
Miller, F. O.
Motley.
Myers, S. B.
Myers, W. S.
Palmer, E. L.
Palmer, J. H.
Rickey.
Robinson, E. A.
Seth.
Sommerville.
Stewart, W. P.
Talty.
Thom.
Ulman.
Willms.

English Constitutional Law and History: Mr. Lee. Monday and Tuesday, 12 m., Room 20. (24).

Brent.
Clarke, G. M.
Dieffenbach.
Ferguson.
Fowler, L. H.
Gemmill.
Gordon.
Hammond.
Hubner.
Kalb, C. W.
Kennard.
McIntosh.
Miller, F. O.
Myers, S. B.
Palmer, E. L.
Palmer, J. H.
Paine.
Rickey.
Robinson, E. A.
Seth.
Stewart, W. P.
Talty.
Ulman.
Willms.

Philosophy. (60 Students).

Classes meet in Room 12, McCoy Hall.

History of Philosophy: Professor Griffin. Friday, 3 p. m. (10).

Brander.
Caldwell.
Cator.
Ewing.
Guttmacher.
Motley.
Osmond.
Rosenau.
Schanfarber.
Smith, E. A.

Deductive and Inductive Logic: until December 24: ***Psychology:*** January 1 to April 1; ***Ethics:*** after April 1: Professor Griffin. Daily, 11 a. m. ***Outlines of the History of Philosophy:*** Weekly. (50).

Ballard.
Bestor.
Brent.
Browne, B. B.
Cator.
Clarke, G. M.
Cook, H. W.
Dieffenbach.
Dohme.
Duffy.
Ferguson.
Fischer, J. S.
Fitzgerald.
Fowler, L. H.
Francis, W. W.
Gordon.
Hammond.
Harry, P. W.
Hirshberg.
Hodges, C. S.
Hubner.
Jones, A. D.
Jones, R. H.
Kalb, C. W.
Kennard.
Lehr.
Lucke.
McIntosh.
Miller, F. O.
Miller, R. D.
Myers, S. B.
Osmond.
Palmer, J. H.
Pender.
Pyle.
Renouf, V. A.
Robinson, E. A.
Scholl.
Seth.
Smith, F. W.
Smith, R. M.
Smith, V. E.
Stearns.
Stewart, W. P.
Stidman.
Straus.
Ulman.
Whitehead.
Wooldridge.
Young.

Drawing. (82 Students).

Classes meet in the Howard Street building, Rooms 9 and 18.

Freehand Drawing: Mr. WHITEMAN. Tuesday and Thursday, 2–5 p. m. (62).

Abercrombie.
Altvater.
Anderson.
Baetjer, H.
Beeuwkes, C. J.
Bernheim, B. M.
Brady, J. H.
Brooks, C. E.
Burrell.
Clark, C. T.
Constantine.
Crummer.
De Grange.
Diggs.
Donaldson.
Downs.
Eager.
Ember.
Ewell.
Flinn.
Foster, F.
Foutz.
Francis, I. H.
Glaser.
Gminder.
Greene, J. D.
Griffin, J. W.
Heyman.
Hill, H. D.
Hill, J. P.
Homer.
Hyde.
James, R.
Kerr.
Liddell.
Lindheim.
Loeb.
Mackall.
Marshall, T. H.
McAll.
Moore, J. S.
Morrison.
Powell.
Purcell.
Ramsay.
Ross.
Roulston.
Rous.
Schermerhorn.
Shriver.
Smith, S. P.
Snavely, G. E.
Taneyhill.
Turnbull.
Ver Planck.
White.
Whitman.
Wight.
Wingert.
Winslow.
Wirt.
Wright, H. C.

Mechanical Drawing: Mr. GEER. Monday and Tuesday, 2–5 p. m. (20).

Armstrong, J. R. C.
Bartell.
Beale, R. B.
Beeuwkes, R. K.
Brady.
Edmunds.
Everett.
Frank, E.
Gorsuch.
Haldeman.
Hall, C. M.
Haulenbeek.
Hodges, W. L.
Keidel, F. B.
Kershner.
Pender.
Spencer.
Stephens, J. C.
Swaine.
Surface.

Forensics and Elocution. (181) Students.

Classes meet in McCoy Hall.

Forensics: *Third Year* (*Senate*): Mr. LEE. Alternate Wednesdays, 11 a. m., Donovan Room. (52).

Ballard.
Bestor.
Brent.
Browne, B. B.
Clarke, G. M.
Clunet.
Cook, H. W.
Dieffenbach.
Dohme.
Duffy.
Ferguson.
Fischer, J. S.
Fitzgerald.
Fowler, L. H.
Francis, W. W.
Gordon.
Hammond.
Harry, P. W.
Harwood.
Hirshberg.
Hodges, C. S.
Hubner.
Jones, A. D.
Jones, R. H.
Kalb, C. W.
Kennard.
Lehr.
Lucke.
McIntosh.
Miller, F. O.
Miller, R. D.
Myers, S. B.
Osmond.
Palmer, J. H.
Pender.
Pyle.
Rayner.
Renouf, V. A.
Robinson, E. A.
Scholl.
Seth.
Smith, F. W.
Smith, R. M.
Smith, V. E.
Stearns.
Stewart, W. P.
Stidman.
Straus.
Ulman.
Whitehead.
Wooldridge.
Young.

Forensics: *Second Year* (*House of Representatives*): Mr. LEE. Alternate Wednesdays, 11 a. m., Donovan Room. (51).

Armstrong, J. R. C.
Bogue.
Bruce.
Chambers.
Davidson.
Downes.
Fisher, F. C.
Fooks.
Fosnocht.
Frank, S. W.
French.
Gaddess.
Gemmill.
Greenbaum.
Greene, J. D.
Grimes.
Guggenheimer.
Hanna.
Haskell.
Jones, T. D.
Joyner.
Jungbluth, K.
Jungbluth, M.
Kalb, J. A.
Kaufman, H.
Keidel, A.
King, J. H.
Knapp.
Krager.
Kurrelmeyer, H.
Lazenby.
Levering.
Morgan.
Mullen.
Murkland.
Palmer, E. L.
Ramsey.
Remsen, C. M.
Reymann.
Robinson, G. C.
Ross.
Smull.
Spilman.
Talty.
Taneyhill.
Taveau.
Thomas, R. H.
Tobin.
Ver Planck.
Werber.
Wright, A.

Elocution: *First Year:* Mr. LEE. Assembly Room.

Section I. Monday, 9 a. m. (18).

Abercrombie.
Adams, T. S.
Altvater.
Baetjer, H.
Beeuwkes, C. J.
Ewell.
Francis, I. H.
Glaser.
Greene, J. D.
Heyman.
Kerr.
Lindheim.
Loeb.
Ramsay, R. L.
Rous.
Smith, S. P.
Ulman.
Wingert.

Section II. Tuesday, 10 a. m. (19).

Clark, C. T.
Flinn.
Gminder.
Hubner.
King, J. H.
Liddell.
Marshall, T. H.
McAll.
Moore, J. S.
Powell.
Rickey.
Schermerhorn.
Seth.
Taneyhill.
Turnbull.
White.
Whitehead.
Wight.
Wright, H. C.

Section III. Thursday, 12 m. (20).

Bouchelle.
Brady, J. H.
Breed.
Burrell.
Donaldson.
Foster, F.
Foutz.
Gaddess.
Gardner.
Griffin, J. W.
Jones, T. D.
King, T. H.
Mackall.
Morrison.
Roulston.
Shriver.
Smith, W. L.
Ver Planck.
Whitman.
Winslow.

Section IV. Friday, 1 p. m. (19).

Anderson.
Brooks, C. E.
Crummer.
De Grange.
Diggs.
Eager.
Ember.
Fischer, J. S.
Grimes.
Hill, H. D.
Hill, J. P.
Hyde.
Purcell.
Ross.
Routh.
Sioussat.
Smith, V. E.
Wirt.
Wright, A.

Debate: *Advanced Limited Class:* Mr. LEE. Wednesday, 9 a. m., Donovan Room. (14).

Ballard.
Cator.
Dieffenbach.
Fischer, J. S.
Gardner.
Hammond.
Hodges, C. S.
Kennard.
Lucke.
Pyle.
Seth.
Stearns.
Willms.
Young.

Public Speaking: *Advanced Limited Class:* Mr. LEE. Tuesday, 1 p. m., Donovan Room. (11).

Fischer, J. S.
French.
Grimes.
Guggenheimer.
King, J. H.
Morgan.
Mullen.
Murkland.
Remsen, C. M.
Reymann.
Ross.

Public Speaking: Mr. LEE. Friday, 12 m., Assembly Room. (17).

Anderson.
Beeuwkes, C. J.
Brooks, C. E.
Burrell.
De Grange.
Foster, F.
Greene, J. D.
Griffin, J. W.
Hyde.
Kaufman, H.
Liddell.
Lindheim.
Loeb.
McAll.
Schermerhorn.
Shriver.
Smith, W. L.

COMMEMORATION DAY.

The twenty-second anniversary of the University was celebrated on Tuesday, February 22. The public exercises were held in McCoy Hall.

The address of the day was by President Charles K. Adams, of the University of Wisconsin, on State Aid to Higher Education. (This address has been printed in pamphlet form.)

The degree of Doctor of Philosophy was conferred upon

Charles William Peppler, of Baltimore, A. B., Johns Hopkins University, '92, Fellow by Courtesy, '97–'98. His studies were Greek, Latin, and Sanskrit. His thesis is entitled "The Comic Terminology in Aristophanes and the Comic Fragments."

Ebenezer Emmet Reid, of Lynnhaven, Va., A. M., Richmond College, '92, Fellow of the Johns Hopkins University, '97–'98. His studies were chemistry, physics, and mathematics. His thesis is entitled "Studies in the Hydrolysis of Acid Amides."

William Berney Saffold, of Selma, Ala., A. B., University of Alabama, '87, LL. B., '88, and A. M., '89. His studies were Latin, Greek, and Sanskrit. His thesis is entitled "The Construction with Verbs of Commanding at Different Periods of the Latin Language."

The degree of Bachelor of Arts was conferred upon

Robert Ernest Belknap, of New York.

William Cazenove Gardner, of Maryland.

Charles Smith Lewis, of New York (*extra ordinem*).

President Gilman announced that the portrait of Professor Simon Newcomb presented to the University by his colleagues, friends, and pupils, had been finished and placed on the walls of McCoy Hall. The portrait was painted by Mr. R. G. Hardie, of Boston.

Professor Adams announced that the John Marshall prize had been awarded for this year to Professor Charles D. Hazen, of Smith College, Mass., a graduate of this University in 1893, for his work on "Contemporary American Opinion of the French Revolution."

President Gilman then read the following minute, which was adopted by the board of trustees at a meeting held before the exercises:

"In accordance with the wishes of many of its friends and supporters, taxpayers and citizens of Maryland, the Johns Hopkins University has determined to present a statement of its financial condition to the Legislature of Maryland, and to ask for State aid. They will in their memorial set forth the work accomplished by the University and their reasons for seeking an appropriation. In support of this memorial they ask the co-operation of the newspapers of the city and State and also of intelligent individuals in public and private life, including the alumni of the University, of whom thirteen hundred are Marylanders. Ample statements have been prepared for submission to the Legislature, on whose favorable consideration the University relies with confidence and hope."

A meeting of the general Alumni Association was held in Baltimore, February 22, in the morning. Officers were elected as follows:—

Joseph Sweetman Ames, A. B., '86, and Ph. D, '90, president; Alfred Jenkins Shriver, A. B., '91, secretary; Henry Oliver Thompson, A. B., '87, treasurer; Wyatt William Randall, Ph. D., '90, John Hemsley Johnson, A. B., '81, Robert Milligan McLane, Jr., A. B., '87, Charles Gambrill Baldwin, A. B., '92, and Dudley Williams, A. B., '97, executive committee.

The Association had its eleventh annual banquet at the Hotel Rennert in the evening. Addresses were made by President Gilman, Mr. Charles J. Bonaparte, Major Richard M. Venable, Prof. Woodrow Wilson, and others.

The Northwestern Alumni Association met at the University Club in Chicago at noon. Addresses were made by Frederick Jackson Turner, Ph. D., '90, now professor of American history at the University of Wisconsin, and by James Taft Hatfield, Ph. D., '90, now professor of German in Northwestern University.

ABSTRACTS OF PAPERS READ AT RECENT MEETINGS OF THE UNIVERSITY SCIENTIFIC ASSOCIATION.

One Hundred and Thirty-fourth Regular Meeting, November 23, 1897.

The following communication was presented and read:

"The Yerkes Observatory and the Exercises held in connection with its Dedication." By CHARLES LANE POOR.

The speaker gave an account of the dedication of the Yerkes Observatory and of the Astronomical Conferences which were held in connection therewith. These Conferences were exceedingly interesting and were remarkably well attended, a number of very important papers being presented. The Observatory was described, special attention being given to the great Yerkes telescope and to its accessories, the dome and elevating floor. A number of lantern slides of the Yerkes Observatory in its complete state as well as in the process of erection were shown. A series of interesting views of the great telescope were also shown.

One Hundred and Thirty-fifth Regular Meeting, December 16, 1897.

The following communication was presented and read:

"The Electric Furnace in its Relations to Chemistry." By IRA REMSEN.

The speaker gave an account of the recent work of H. Moissan on chemical action at high temperatures. The work was made possible by the invention of the electric furnace. This is made of marble, which under the influence of the high temperature of the electric arc is converted, at least partly, into lime. It consists of two blocks so hollowed out in the centre that the poles of a powerful battery can be brought near together in the cavity. By means of the temperature thus produced, very remarkable chemical changes can be effected. M. Moissan has succeeded in making in quantity a number of chemical compounds and elements in pure condition that have hitherto been known mainly as curiosities, and perhaps the most interesting of the phenomena described by him are those which led to the formation of diamonds. He carefully reviewed all previous work on this subject and reached the conclusion that no one of the methods hitherto employed can be used successfully for the purpose of making diamonds. After a number of preliminary experiments he finally succeeded, by dissolving carbon in molten iron at a temperature above 3000° Centigrade, and plunging the crucible containing the molten mass into cold water. The sudden cooling of the iron on the outside caused high pressure upon the mass within, and under these circumstances a part of the carbon crystallized out in the form of minute diamonds. These were examined very thoroughly and shown beyond a doubt to be diamonds. M. Moissan does not expect to make large diamonds by this method, and does not express any special interest in the possible practical applications of this discovery, but he points out that the work thus far done on this subject justifies the conclusion that the diamonds found in the earth have probably been formed by processes similar to those which he has used successfully. He thinks that they have been formed at great depths in the earth and that they have crystallized from molten iron under great pressure.

Among the elements obtainable in quantity by means of the electric furnace are chromium, manganese, molybdenum, tungsten, uranium, vanadium, zirconium, titanium, silicon, and aluminium. The principal compounds described in M. Moissan's book, many of them for the first time, are the carbides, silicides, and borides. Among the carbides occurs the now famous calcium carbide which has attracted so much attention on account of the fact that it yields acetylene when treated with water. The carbide of aluminium is also of special interest because when it is treated with water it yields methane or marsh gas. Uranium carbide yields a mixture of hydrocarbons not unlike petroleum. These decompositions indicate the possibility that petroleum is formed, at least to some extent, by the action of water on carbides in the interior of the earth. Indeed M. Moissan claims that the evidence is sufficient to justify a very positive statement on this subject. Certainly the results reached by him have brought again into great prominence this theory of the formation of petroleum, which was first proposed by Mendeléeff.

One Hundred and Thirty-sixth Regular Meeting, January 20, 1898.

The following communication was presented and read:

A Trip Through Russia in Connection with the Seventh International Geological Congress. By WILLIAM B. CLARK.

The paper, which was illustrated with lantern slides, described the organization and proceedings of the Seventh International Geological Congress at St. Petersburg, which took place during the summer of 1897 and which was preceded and followed by extended excursions through the Russian Empire. The excursion into Finland and the long journey into Southern Russia and Caucasia by way of Moscow and the Volga were described and the physiographical, geological, ethnographical and other features of the country traversed were considered. The trip across the Caucasus Mountains with side excursions into the high regions with their glaciers and snowfields presented much of interest to geologists, while the later journey through Georgia to the Caspian Sea and subsequently to the Black Sea at Batoum afforded the author of the paper an opportunity of seeing some of the most interesting and most distant parts of Russia. The journey closed with several days spent in a study of the geology and historical monuments of the Crimea, the Congress disbanding at Odessa early in October.

The Geometrical Constitution of Magnetic Fields.

By RENÉ DE SAUSSURE.

WASHINGTON, *January* 3, 1898.

PROF. H. A. ROWLAND,
Johns Hopkins University.

Dear Sir,—In making a geometrical study of the motion of a rigid body, I found that the ordinary laws of motion are applicable to any magnetic field and that therefore the geometrical constitution of such a field is not based upon any principle of mechanics or physics but is, like kinematics, a direct result of the axioms of geometry. And first, what is a magnetic field, geometrically speaking?

Consider any rigid plane figure on which there is marked a point M and a straight line D passing through M; such a body is completely determined in its plane, as soon as the position of the point M and the direction of the line D are given. The position of the plane body depends therefore on three parameters, just like a point in space; but in the geometry of the point in space it is customary to consider points, lines and surfaces, so in the geometry of the position of a rigid body in a plane we shall consider three phenomena: (1°) a unique *position* of the body MD, (2°) a single infinity of positions forming a continuous series and defining a certain *displacement* of the body in the plane, (3°) a double infinity of positions forming a continuous series; this is precisely the phenomenon presented by a plane magnetic *field*, for we can suppose the body MD to be a small magnetic needle whose center is the point M and whose axis coincides with the line D; by displacing this needle in the field, we can bring M in coincidence with any given point of the plane, but as soon as M is located, the needle takes a definite position, so that the total number of positions, which the needle can take is doubly infinite. A plane magnetic field must then bear the same relation to the displacement of a rigid body in a plane as a surface of points bears to a line of points. In space, the line taken as a standard is the straight line, because between two given points there is always a straight line and only one; for the same reason, the displacement of a plane body taken as a standard for all other displacements is the rotation or *circular displacement*, since two positions of the plane body determine a rotation and only one. Again in space, the surface taken as the standard surface is the plane, because it is a surface such that the straight line joining any two points of the surface has all its other points on the surface too. Therefore, it is natural to look for a standard magnetic field, which may be used to study any other field; if such a field exists, its definition shall be as follows: it is a field such that by joining any two positions of the needle MD in the field by a circular displacement, all the positions which the needle takes during this displacement shall also belong to the field. For this reason, the standard magnetic field may be called a *circular field;* the existence of a circular field may be proved in the following manner:

Consider in the plane a fixed point O and a straight line OM (Fig. 1); suppose that when the point M describes the line OM, the needle MD remains parallel to itself, but when the line OM turns around O, the needle MD revolves twice as fast around its center M; the magnetic field thus defined is a circular field and the point O is its *center* or *pole*. To prove this, we can make use of the following property of this field: whenever the needle is displaced in the field in such a way that its center M describes a circle passing through the point O, the displacement of the needle will be precisely the same as if the needle were rotated around the center C of this circle. For, let M and M' be any two positions of the point M on the circle, and MD, $M'D'$ the corresponding positions of the needle; according to the definition of the field the angle between MD and $M'D'$ is twice the angle MOM', but the angle at the centre MCM' is also twice the inscribed angle MOM'; hence if the needle MD be rotated around C it will sooner or later take the position $M'D'$. But M' is any point of the circle, hence, during the whole circular displacement the needle remains in the field. If we take now any two positions of the needle in a circular field such as MD and $M'D'$, we can always pass a circle through the points M, M' and O and if the needle be rotated around the center C of this circle, it will not leave the field and will pass through the two given positions MD and $M'D'$; but between any two positions of a plane body there exists but one circular displacement. We see then that the circular field is such that the circular displacement determined by any two positions of the needle belongs to the field, and further that this circular displacement always passes through the pole of the field.

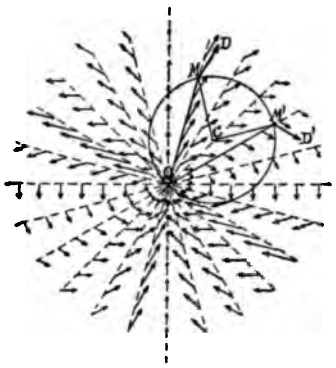

FIG. 1.

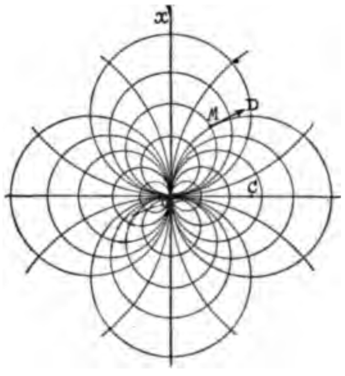

FIG. 2.

To determine the lines of force of a circular field, let MD be any position of the needle in the field (Fig. 2); draw a circle tangent to the line D and passing through the points M and O. When M describes this circle, MD turns around the center C of this circle, hence MD remains tangent to the circle, i. e.: this circle is the line of force passing through M and it is easy to see that all lines of force are circles passing through the pole O and tangent to the same line OX. By turning these lines of force of a right angle around the center O, we get a second system of circles, which cuts the first orthogonally.

I happened to speak of this circular field to Mr. Ed. Gallaudet, instructor of physics in Yale University, and he remarked to me that this field has the same lines of force as a field produced by an infinitely short magnet placed at the center O in the direction OX. It is remarkable that we have been led to the consideration of this field by relations purely geometrical, involving no principle of physics, much less the law of the inverse of the square of the distance, which is assumed in magnetism.

The circular field can be used in the study of any other field just as the plane is used in the study of surfaces. For instance, it takes three points to determine a plane in space; in the same way, it takes three positions of the needle to determine a circular field: let MD, $M'D'$, $M''D''$ be these three positions; the two positions MD and $M'D'$ determine a certain rotation and the positions MD and $M''D''$ determine another rotation; the circles MM' and MM'' described by M during these rotations intersect at M and at a second point O. This point is the pole of the circular field passing through the three given positions, because it contains two circular displacements passing through these positions.

The two positions $M'D'$ and $M''D''$ determine a third rotation which must belong to the same field, i. e.: the circle $M'M''$ described by M in this third rotation must also pass through O. But the rotation which brings the needle from the position $M'D'$ to the position $M''D''$ is the resultant of the two rotations ($M'D'$, MD) and (MD, $M''D''$). We see then that two rotations of a plane body determine a circular field which contains also the resultant rotation, and this remark leads to the law of composition of two finite rotations in a plane. Let ω be the angle of the first rotation, ω' that of the second and c, c' the centres of the rotations; give to any point m of the plane the rotation ω around c, this will bring m somewhere in m'; give to m' the rotation ω' around c', and let m'' be the final position of m'; the circles mm' and $m'm''$ determined by these rotations intersect in m' and in a second point o, which is such that the circle mom'' will determine the center of the resultant rotation, and the arc mm'' the angle of this resultant.

Being given a surface in space and three points on this surface not far from each other, the plane passing through these three points is a plane tangent to the surface, i. e.: a plane which coincides with the surface in the vicinity of the three points. In the same way, being given any magnetic field and three positions of the needle, not far from each other, these three positions determine a circular field *tangent* to the given field, i. e.: a circular field which can be substituted to the given field in the vicinity of the three positions; the circular lines of force of this tangent field will coincide very nearly with the real lines of force of the given field in the same vicinity. Now, if we were to place an infinitely short magnet at the pole of this tangent circular field and place the needle near the point of contact of the two fields, the effect produced by this magnet would be the same as the effect produced by all the magnets, which may be in the given magnetic field, since the two fields coincide near their point of contact. Hence, the resultant magnetic action at any point of a magnetic field, is the same as would be produced by a single short magnet placed at the pole of the circular field tangent to the given field at this point.

Another fundamental property of circular fields is that the intersection of two circular fields is always a circular displacement and this theorem corresponds in space to the fact that the intersection of two planes is always a straight line. Let O and O' be the poles of two circular fields and MD a position of the needle common to both fields; if we draw a circle through O, O' and M and let MD turn around the center of this circle, it is evident that during the whole rotation the positions of the needle belong to both circular fields. Three circular fields have only one position of the needle in common, which is determined by taking the intersections of the fields two and two; this will give three circular displacements passing through the same position.

These remarks are sufficient to show the use of circular fields in the study of any irregular field in a plane; I shall develop the subject and use circular fields in the study of motion of a plane body just as planes are used in space in the study of a twisted curve. I also hope to extend the theory to magnetic fields on a sphere and to any magnetic field in space; but this is all I can submit to you for the present.

Very respectfully yours,

RENÉ DE SAUSSURE.

AN ENCOURAGING VIEW OF AMERICAN CITIES.

(*Abstract of a Lecture given to Students of Historical and Political Science, at the Johns Hopkins University, by* TALCOTT WILLIAMS, *Editor of The Press, Philadelphia.*)

Mr. Williams began his address by a general comparison of American and European cities. In making the comparison, not magnificence but the comfort of the citizens should be considered. The first element of comfort is room. The population of the average American city is distributed over much more ground than that of the average European city, necessitating, therefore, a greater expense for paving, for lighting and cleaning the streets and for water and sewage facilities. Also, a greater variableness in meteorological conditions produces for American cities peculiar problems. The rain-fall, for example, is greater, the entire rainy period less, and during this period there is a greater irregularity of rain-fall than in Europe. The reason why the sewers of Berlin or London never break, as is sometimes the case in Philadelphia, is that in these cities it never rains hard enough to break a sewer.

Again a greater variation of temperature presents to American cities peculiar difficulties. For example, an asphalt pavement is sure to deteri-

ɛer under a swing of 160 degrees of temperature than under a
100 degrees as is the case in northern Europe. To meet these
ɔgical extremes, a better grade of work, and therefore a greater
is necessary. Moreover, the death rate among children is in-
ɔy the high temperature of summer, and the pulmonary diseases
to the winter climate of America increase the death rate still
ɔy cutting life short at the other end. Therefore, American cities
ɛssarily neglect magnificence. In comparing them with European
; magnificence but the difficulties overcome and the relative comfort
izens must be considered. American cities do not choose to have a
in every square but choose rather to have a bath-tub in every home.
·owing influence of universities upon the life of the people shows
ɜt imperceptible yet certain development of higher institutions in
ı society. Some universities, like Columbia, on account of their
ɪdowment, have long been segregated and apart from the people.
r universities, like the University of Pennsylvania, have had the
ɪune to be born poor. This university has grown only by the
ɪaken in it by the people of Philadelphia and of Pennsylvania.
ı, it has ever had in mind its obligation to the people in whose
ɜtands. The university has become a part of the city and the city
' the university. Its interests, however, extend beyond the city.
out the state, to social clubs, to organizations for educational pur-
ıerever the people desire instruction, the university sends its
atives.

riginal gift of land from the city was twenty six acres, subse-
ncreased by thirteen acres. The city has invested large amounts
rships of the University of Pennsylvania, of Bryn Mawr, and of
stitutions. The present educational facilities in Philadelphia are
the humblest laborer, if able to keep his child in clothing, may
on, without being at any expense for tuition, start in the kinder-
ıd go to the end of as good a legal course as the country affords
ɜe his daughter advance from the same beginning and become a
of Bryn Mawr.

ɪrd to the finances of the University of Pennsylvania, Mr. Williams
ere are about 7000 men in eastern Pennsylvania, 4000 of whom
ıiladelphia, who aid the university with their means. In it, also,
vate corporations have an active interest. But the most valuable
l is the State of Pennsylvania. About every two years, the repre-
ɜ of the university go to the legislature and ask for $200,000 and
y is obtained. Thus the "city of homes" and the State of Penn-
hand in hand with the state's great university, are developing in
tion, originally blown like a sand dune across the Atlantic, a
ɜstitutional life.

PROCEEDINGS OF SOCIETIES.

Association.
47.

cal Association.
ɜred and sixty-second regular meeting. December 17, 1897.
ɜad:
fluence of Laurence Sterne on German Literature, by T. S. Baker.
ıatical and Etymological Notes, by M. Bloomfield.
ɜred and sixty-third regular meeting. January 21, 1898.
ɜad:
Genesis of the Polychrome Bible, by P. Haupt.
lar's Mistakes, by W. H. Browne.
ɜred and sixty-fourth regular meeting. February 18, 1898.
ɜad:
ıglish of Tennyson's In Memoriam, by H. E. Shepherd.
ations in Juvenal and Martial, by H. L. Wilson.

ıl and Political Science Association.
· 3.
sions of Geneva, by J. M. Vincent.
under the Third Republic, by C. W. Paine.
under Louis XIV, by H. Campbell.
Transformation of England, by E. J. Benton.
tism in American Government, by G. E. Barnett.
ation for Elective Offices, by L. F. Schmeckebier.
ɪc Prophecy, by C. C. Weaver.

December 17.
- Impressions of Berlin, by Sidney Sherwood.
- Christianity and the Labor Conflict, by E. A. Smith.
- Heinrich von Treitschke, by G. L. P. Radcliffe.
- Fiske's "Old Virginia and Her Neighbors," by C. W. Sommerville.
- The Popular Mind, by J. J. Cantey.
- Zimmerman's "Universities in the U. S.," by T. S. Adams.
- Machiavelli, by W. T. Thom.

January 7.
- Impressions of Munich, by T. S. Baker.
- John Randolph of Roanoke, by C. W. Sommerville.
- Zwiedineck-Südenhorst's "Deutsche Geschichte," by L. F. Schmeckebier.
- Cid Campeador, by St. G. L. Sioussat.
- Border Wars of New England, by P. L. Kaye.

January 21.
- Intervention of the United States in Cuba, by J. H. Latané. (Published in North American Review, March 1898.)
- Rogers' "Interpretation of History," by W. E. Schloegel.
- Europe in Africa in the Nineteenth Century, by D. E. Motley.
- Bryce's Views on the Annexation of Hawaii, by J. R. Ewing.

February 4.
- The Colonial Executive before the Restoration, by P. L. Kaye.
- Political and Social Science in Modern Education, by Robert Garrett.
- Haskins on Mediaeval Student Life, by G. L. P. Radcliffe.

February 18.
- The United States Legal Tender Acts, by St. G. L. Sioussat.
- Postal Savings Banks, by C. H. Brough.
- Bryce's "Impressions of South Africa," by W. S. Myers.
- Justin Winsor, by C. W. Sommerville.
- Marsiglio of Padua and William of Ockam, by C. Snavely.
- The National Banking System, by G. E. Barnett.
- Revival of French Universities, by L. F. Schmeckebier.

March 4.
- Constitutional Amendment and a New Federal Convention, by James Schouler.
- Corporation Finance, by H. Campbell.
- Nullification and Secession, by E. J. Benton.
- War of Greek Independence, by P. L. Kaye.
- Civil War and Reconstruction, by J. J. Cantey.

PUBLIC MEETINGS AND SOCIAL ASSEMBLIES

Recently held in the University Buildings:

- A meeting of the Archaeological Institute of America, Baltimore Society, in the Donovan Room, December 11.
- Three musicales by the Johns Hopkins University Musical Association, in McCoy Hall, December 18, January 15, February 12.
- Annual meeting of the American Folk-Lore Society, in the Donovan Room, December 28 and 29.
- Meetings of the Baltimore Folk-Lore Society, in the Donovan Room, January 14 and February 25.
- An illustrated lecture on new methods of instruction in Drawing, by Mr. J. Liberty Tadd, of Philadelphia, under the auspices of the Baltimore Country School for Boys, in Levering Hall, January 15.
- The annual meeting of the Baltimore Society for the Suppression of Vice, in Levering Hall, January 20.
- A meeting of the Bank Clerks' Association of Baltimore, in Levering Hall, January 21.
- Meeting of the Friendly Visitors of the Charity Organization Society, in Levering Hall, January 25.
- Meetings in connection with the annual convention of the Young Men's Christian Associations of Maryland, West Virginia, Delaware and the District of Columbia, in Levering Hall, January 29 and 30.
- An illustrated lecture on "Home Life in Pompeii," by Professor Morris H. Morgan, of Harvard University, under the auspices of the Archaeological Institute of America, in McCoy Hall, January 29.
- A lecture, under the auspices of the Kindergarten Association of Baltimore, in Levering Hall, February 1.
- A reception by the Young Men's Christian Association of the University in honor of President Patton, in Levering Hall, February 7.
- A meeting of the Lawrence Memorial Association in Levering Hall, February 13.

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HOURS FOR LECTURES AND RECITATIONS, SECOND HALF-YEAR, 1897-98.

HOURS.	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
A. M. 9	Theory of Functions: Adv. (Craig.) Analytical Chemistry. (Morse.) Descriptive Astronomy. (Poor.) Italian: Elective. (Baxter.) German Readings. (Baker.) Electricity. (Duncan.) Geological Physics. (Reid.) Spanish: Elective. (Kuersteiner.) Trigonom.: Analytic Geom. (Cohen.) English Literature. (Greene.) Economic Sociology. (Sherwood.) Elocution. (Lee.) Latin Pro-Seminary. (Smith.) French: Elective. (Armstrong.)	Theory of Functions: Adv. (Craig.) Organic Chemistry. (Remsen.) Gen. Chem.: Minor. (Renouf & Randall.) Chemistry: Major. (Morse.) Latin Composition. (Wilson.) Italian: Minor. (Rambeau.) German Seminary. (Wood.) Mathematics: Major. (Hulburt.) Electricity. (Duncan.) Southern Hist. Conf. (Ballagh.) Historical Geology. (Clark.) French: Elem. (Kuersteiner.) Physiology: Major. (Dreyer.) Differential Equa. (Cohen.) (8 a. m.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Ricardo. (Hollander.) Aristotle. (Miller.) Roman Literature. (Smith.) Arabic Geographers. (Johnston.)	Organic Chemistry. Remsen.) Gen. Chem.: Minor. (Renouf & Randall.) Chemistry: Major. (Morse.) Horace. (Wilson.) Italian: Minor. (Rambeau.) Schiller's Dramas. (Wood.) Mathematics: Major. (Hulburt.) Electrical Seminary. (Duncan, Hering, Geer.) Historical Geology. (Clark.) Physiology: Major. (Dreyer.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Ricardo. (Hollander.) Debate. (Lee.) French Philology. (Armstrong.)	Theory of Functions: Adv. (Craig.) Organic Chemistry. (Remsen.) Gen. Chem.: Minor. (Renouf & Randall.) Chemistry: Major. (Morse.) Horace. (Wilson.) Italian: Minor. Rambeau.) German Seminary. (Wood.) Mathematics: Major. (Hulburt.) Electricity. (Duncan.) Geological Physics. (Reid.) French: Elem. (Kuersteiner.) Physiology: Major. (Dreyer.) Differential Equa. (Cohen.) (8 a. m.) Spanish: Minor. (Marden.) Theory of Credit. (Sherwood.) Aristotle. (Miller.) Hebrew Exercises. (Johnston.)	Math. Conference. (Craig.) Organic Chemistry. (Remsen.) Gen. Chem.: Minor. (Renouf & Randall.) Chemistry: Major. (Morse.) Horace. (Wilson.) Italian: Minor. (Rambeau.) German Seminary. (Wood.) Mathematics: Major. (Hulburt.) Electricity. (Duncan.) General History Exam. (Ballagh). French: Elem. (Kuersteiner.) Physiology: Major. (Dreyer.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Theory of Credit. (Sherwood.) Greek Composition. (Miller.) Latin: Elective. (Smith.)	Chemistry: Journal Meeting. (9-10.30.) Physical Seminary. (Ames.) Geology: Journal Club.
10	Greek Seminary. (Gildersleeve.) Light. (Rowland.) Physics: Minor. (Ames.) Osteology. (Andrews.) Electrical Measurements. (Hering.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10-5.) Latin Composition. (Smith.) German: Major. (Wood.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Herodotus and Greek Comp. (Miller.) Old Spanish Readings. (Marden.) Economics. (Hollander.) Historical Politics. (Vincent.) French Philology. (Armstrong.) German Literature. (Vos.)	Greek Syntax. (Gildersleeve.) Light. (Rowland.) Descriptive Astronomy. (Poor.) Trigonom.; Analytic Geom. (Cohen.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10-5.) French Phonetics. (Rambeau.) English Literature. (Greene.) Arabic Geographers. (Johnston.) Elocution. (Lee.) Historical Method. (Vincent.) German Readings. (Baker.)	Greek Seminary. (Gildersleeve.) Physics: Minor. (Ames.) Osteology. (Andrews.) Theoretical Astronomy. (Poor.) Theory of Numbers. (Cohen.) Elliptic Functions. (Chessin.) Zoology: Adv. (Brooks.) (10-5.) Plautus and Terence. (Smith.) German: Major. (Vos.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Arabic: Elem. (Johnston.) Spanish Philology. (Marden.) Economics. (Hollander.) Historical Politics. (Vincent.) Ovid, Vergil, etc. (Wilson.) Gothic. (Wood.)	Plato. (Gildersleeve.) Light. (Rowland.) Physics: Minor. (Ames.) General Biology. (Andrews.) Theoretical Astronomy. (Poor.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10-5.) Plautus and Terence. (Smith.) German: Major. (Wood.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Hebrew Exercises. (Johnston.) Spanish Seminary. (Marden.) Economics. (Hollander.) Historical Method. (Vincent.) Ovid, Vergil, etc. (Wilson.) German Literature. (Vos.)	Homer. (Gildersleeve.) Light. (Rowland.) Physics: Minor. (Ames.) General Biology. (Andrews.) Electrical Measurements. (Hering.) Theory of Numbers. (Cohen.) Zoology: Adv. (Brooks.) (10-5.) Plautus and Terence. (Smith.) German: Major. (Baker.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Biblical Antiquities. (Johnston.) Spanish Philology. (Marden.) Economics. (Hollander.) Ovid, Vergil, etc. (Wilson.) Gothic. (Wood.)	
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2	Mechanical Drawing. (Geer.) Zoology: Elective. (Andrews.)	Mechanical Drawing. (Geer.) Drawing. (Whiteman.)		Drawing. (Whiteman.)		
3	Arabic Composition. (Haupt.) Hebrew Composition. (Haupt.) (3.30.) Mechanical Drawing. (Geer.) Zoology: Elective. (Andrews.) Old French Readings. (Armstrong.)	Compar. Hebrew Grammar. (Haupt.) English Seminary. (Bright.) Mechanical Drawing. (Geer.) Drawing. (Whiteman.)	Hebrew: Elem. (Haupt.) Old French Readings. (Armstrong.)	English Seminary. (Bright.) The Avesta. (Ness.) Drawing. (Whiteman.) Congressional History. (Hollander.)	History of Philosophy. (Griffin.)	
4	Compar. Philology. (Bloomfield.) Hebrew: Second Year. (Haupt.) Mechanical Drawing. (Geer.) Zoology: Elective. (Andrews.)	Lithuanian. (Bloomfield.) Ezra. (Haupt.) English Seminary. (Bright.) Mechanical Drawing. (Geer.) Drawing. (Whiteman.) Structural Geology. (Willis.)	Hebrew: Elem. (Haupt.) English Versification. (Bright.)	Comparative Grammar. (Bloomfield.) English Seminary. (Bright.) Economic Seminary. (Sherwood and Hollander.) Drawing. (Whiteman.) Structural Geology. (Willis.)	Vedic Seminary. (Bloomfield.) English Journal Club. (Bright.) (Alternate Fridays.) Political Conference. (Willoughby.) (Alternate Fridays, 4-6.)	

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NOTES FROM THE PHYSICAL LABORATORY.

EDITED BY JOSEPH S. AMES, PH. D.,

ASSOCIATE PROFESSOR OF PHYSICS AND SUB-DIRECTOR OF THE PHYSICAL LABORATORY.

Some New Methods for the Measurement of Self Inductance, Mutual Inductance and Capacity. By H. A. ROWLAND and T. D. PENNIMAN.

In the *American Journal of Science*, December, 1897, and in *Phil. Mag.*, January, 1898, one of us published an account of a large number of new methods for the measurement and comparison of self-inductance, mutual inductance and capacity. Several of these methods have been tested in the Physical Laboratory of the University with great success, notably the methods for the *comparison* of the above quantities.

The methods involve the use of the electrodynamometer with an alternating current, and depend on one general principle—that is, that the deflection of the hanging coil of an electrodynamometer, if the hanging coil and the fixed coils of the electrodynamometer are originally at right angles, is proportional to the product of the currents in the hanging coil and the fixed coils, together with the cosine of the phase difference of the two currents. The dependence of the deflection on the cosine of the phase difference of the currents divides the methods into two general classes—methods in which there is a deflection; i. e., the cosine of the phase difference has a value; and methods of zero deflection, i. e., the cosine of the phase difference is equal to zero. The first class of methods gives the self-inductance or capacity in terms of resistance and b, i. e., 2π (the number of complete alternations per second of the current). These methods were very easy of application; the chief difficulty was the variation of b, as the current was generated in the power house of the University, where the engine was subject to great change of load. The presence of electric absorption also interfered with the accurate determination of the capacity of condensers. (See note on ABSORPTION, page 52).

The following method is an example of this class, and of the accuracy with which self-inductance can be determined even under these conditions. In this method the fixed coils of the electrodynamometer are in the main line or circuit, and the hanging coil is shunted off the main circuit around a small resistance, r. In the hanging coil circuit is placed a non-inductive resistance, R, with a self-inductance, L, under which condition the hanging coil will have a certain deflection when the current is flowing. They, R and L, are now removed, and a non-inductive resistance, R^1, is substituted, which is adjusted to give the same deflection as when R and L were in circuit. Under these conditions,

$$b^2 L^2 = (R^1 - R)\,(R + r).$$

By this method and similar methods given in the article cited, values of self-inductances were determined that agreed among themselves to within about 1 part in 100; i. e., the determinations were made with about the same degree of accuracy as b could be determined, on which quantity they directly depended. Taking into account absorption, capacity can be determined by the same method with about the same degree of accuracy. This method is easy to use, as it requires but one adjustment, R^1.

The methods for the comparison of the above quantities gave much more accurate results, as they are independent of the period of the current, the great cause of error in the measurement of the quantities. When care was taken to guard against all inductive and electrostatic action of the different parts of the apparatus on each other, the results derived by the different methods tried were remarkably good, notably the results obtained by the method for the comparison of two self-inductances. The connections for this method are made in this manner:

Let there be two coils of self-inductances, B_1 and B_2 placed together, and let the circuit pass through the coil B_2. From the main circuit, after it has passed through the coil B_2, the hanging coil of the electrodynamometer, having in circuit a self-inductance, L, and a resistance, R, is shunted around a small resistance, r. The coil B_1 is placed in circuit with the fixed coils of the electrodynamometer and a resistance, R^{11}.

The condition, then, for zero deflection when the current is flowing is

$$\frac{L}{B_1} = \frac{R + r}{R^{11}}$$

Using this method and taking B_1 as a standard equal to 1 Henry, several coils were compared with B_1, both singly and in series. To show with what accuracy self-inductances of different amounts can be compared, a few values are given for two periods. The coils being compared with B_1 as a standard

	$n = 40$		$n = 133$		
COILS.	Results found by direct measurem't.	Sums and differences of direct measurem't.	Results found by direct measurem't.	Sums and differences of direct measurem't.	Sums and differences.
P_1	.5664	.5663	.5653	.5648	$(C + P_1) - C = P_1$
C	1.3050	1.3049	1.3034	1.3029	$(C + P_1) - P_1 = C$
$C + P_1$	1.8713	1.8714	1.8682	1.8677	$C + P_1$

These are good cases of agreement, and show the accuracy of the method for the comparison of self-inductances of different amounts, when care is taken to eliminate heating and electrostatic action of the resistance and leads.

It will be noticed that the value of the self-inductance for the two periods is different; this was due to the electrostatic action of the turns of the coils on each other, and therefore could not be avoided.

When equal self-inductances are to be compared, the accuracy depends only on the sensitiveness of the instrument to changes in $R+r$; and in the arrangement used in our experiments, the electrodynamometer was sensitive to changes of about 1 part in 10,000 in $R+r$. Therefore the construction of standard self-inductances that will agree with each other to within 1 part in 10,000 is feasible by this method.

Electric Absorption in Condensers. By H. A. Rowland and T. D. Penniman.

The theory of electric absorption and its effect on the capacity of condensers has been developed, and experiments have been carried out to test the theory and results. A short account of the theory was given in the *American Journal of Science*, December, 1897, but since that time a method for the direct measurement of the effect of absorption has been devised, and it is of interest to note the agreement of the results derived by two independent methods.

The condensers used in the experiments were constructed of parallel plates separated by paraffined paper or mica; that is, by a non-homogeneous medium; but Maxwell (El. and Mag., § 329) has shown that absorption is a necessary condition in a condenser whose surfaces are separated by a non-homogeneous medium.

Professor Rowland, starting with the formula as given by Maxwell, has developed the theorem for the case when the electromotive force is periodic, and has deduced the "correction" due to absorption. The formula is thus developed.

Since the insulating plates of the condenser are not homogeneous, they can be considered as made up of strata. The current through any stratum of thickness 1 cm. is

$$\bar{u}=\frac{X}{r_1}+\frac{1}{4\pi K_1}\frac{dX}{dt}$$

when $\bar{u}\equiv$ current per square centimeter.

$r_1\equiv$ specific resistance per unit of volume.

$K_1\equiv$ *inverse* of the dielectric constant.

$X\equiv$ electromotive force on the two sides of the stratum.

If the electromotive force is periodic,

$$X=X_1\,\epsilon^{ibt}$$

Where $b=2\pi$ (complete number of alternations per second). Substituting, we have

$$\bar{u}=\left(\frac{1}{r_1}+\frac{ib}{4\pi K_1}\right)X$$

$$\therefore\quad X=\frac{\bar{u}}{\dfrac{1}{r_1}+\dfrac{ib}{4\pi K}}$$

If there are several strata of different thicknesses, a_1, a_2, a_3, etc.,

$$X^1=\bar{u}\left(\frac{a_1}{\dfrac{1}{r_1}+\dfrac{ib}{4\pi K_1}}+\frac{a_2}{\dfrac{1}{r_2}+\dfrac{ib}{4\pi K_2}}+\text{etc.}\right)$$

where X^1 equal the sum of the electromotive forces on the strata. Expanding and collecting the terms, the equation reduces to the form:

$$X=\bar{u}\left(R+\frac{1}{ibc}\right)$$

where

$$R=\frac{B_0}{b^2}-\frac{B_2}{b^4}+\frac{B_4}{b^6}-\text{etc.}$$

$$\frac{1}{c}=A_0-\frac{A_2}{b^2}+\frac{A_4}{b^4}-\text{etc.}$$

the values of the constants being as follows:

$$B_0=\frac{a_1}{r_1K_1}+\frac{a_2}{r_2K_2}+\frac{a_3}{r_3K_3}+\text{etc.}$$

$$B_2=(4\pi)^2\left\{\frac{a_1}{r_1^3\,K_1^4}+\frac{a_2}{r_2^3\,K_2^4}+\text{etc.}\right\}$$

$$B_4=(4\pi)^4\left\{\frac{a_1}{r_1^5\,K_1^6}+\frac{a_2}{r_2^5\,K_2^6}+\text{etc.}\right\}$$

etc.

$$A_0=4\pi\left\{\frac{a_1}{K_1}+\frac{a_2}{K_2}+\frac{a_3}{K_3}+\text{etc.}\right\}$$

$$A_2=(4\pi)^2\left\{\frac{a_1}{r_1^2\,K_1^3}+\frac{a_2}{r_2^2\,K_1^3}+\text{etc.}\right\}$$

etc.

From the above it appears that a capacity having absorption acts in a circuit as a capacity with a resistance in series with it. The resistance is called "absorption resistance," and appears to vary with b, i. e. with the number of alternations. The capacity proper, i. e. c, will be independent of b if the number of alternations is great.

In the determination of the capacity of two condensers, 2 and 3 microfarads in parallel by Method I (see Note on the Measurement and Comparison of Self-Inductance, Mutual Inductance and Capacity), great variations were found in the deduced values of the capacity (using the ordinary formulae and treating a condenser as if it had capacity only), depending on the resistance in circuit and on the period, the variations being between wide limits, as is shown by the following example:

$n\equiv$ *number of complete alternations per second.*	$R\equiv$ *resistance in circuit with the condensers.*	$C\equiv$ *deduced value of the capacity.*
131.1	21.7	5.47
"	1021.7	4.51
53.3	21.7	6.38
"	1021.7	4.86
31.9	21.7	7.46
"	1021.7	4.92
14.	21.7	10.79
"	1021.7	4.87

But since the condensers possess absorption, and as the effect of absorption as shown in the formula above is that of an added resistance in series with a capacity, therefore the deduced values of the capacity for any particular period should be constant for all values of R, if the value of R is increased by a constant quantity A, the "absorption resistance," depending on the period. Doing this, and correcting the results of which the above are examples, a fair agreement is found for the "true" capacities for the periods used. In the tables below are collected the average corrected values of the capacity, together with n, and A the absorption resistance in ohms.

Capacity in microfarads.	4.94	4.96	4.96	4.64
n	131.1	53.3	31.9	14.
A in ohms.	5.19	20.5	34.09	139.62

In the table the capacity is nearly independent of n, except when $n=14$; but this may be caused by an error in determining n on which the capacity depends directly. A shows remarkable variation with n.

A, however, can be measured directly, and this was done for several condensers, including those used above, so that it was possible to compare two independent determinations of the same quantities.

The method for the direct measurement of absorption resistance involves the use of the Wheatstone bridge and an electro-dynamometer with an alternating current.

If the fixed coils of an electro-dynamometer are placed in one arm with a condenser, and if the hanging coil is placed in the cross connection of the bridge, and a periodic electro-motive force is applied to the terminals of the bridge, the condition that there is no deflection of the hanging coil is that

$$R_{,}R''=R'R_{,,}-\left(b^2lL_{,}-\frac{l}{C}\right)\frac{R''(R'+R'')}{R'(R''+R_{,,})+r(R'+R'')}$$

when $R_{,}\equiv$ resistance of arm with condenser.

$R', R'', R_{,,}\equiv$ resistance of the other arms.

$r\equiv$ resistance of the cross connection.

$L_{,}\equiv$ self-inductance of fixed coils of electro-dynamometer.

$l\equiv$ self-inductance of hanging coil of electro-dynamometer.

$C\equiv$ capacity of condenser.

Since $L_{,}$ is small, the formula reduces to the form:

$$R_{,}R''=R'R_{,,}+\frac{l}{C}\frac{R''(R'+R'')}{R'(R''+R_{,,})+r(R'+R'')}$$

The resistance $R_{,}$ was made up of the ohmic resistance of the arm of the bridge and the absorption resistance.

ɜrmining *R*, by this method, and knowing its ohmic resistance, the tion resistance *A* was found. Using this method, for the condensers bove, *A* was found for a few periods, and it can be seen from the panying table how the values determined by the two methods agree.

n	134.	131.1	57.6	56.6	53.3
lethod I.		5.19			20.5
measurement.	5.30		21.6	22.2	

values as determined by Method I. should be somewhat less than letermined by direct measurement. In Method I. there was practio heating, while in the method of direct measurement there was conle rise of temperature, due to the comparatively large current flowing h the condensers; and it was found that the absorption resistance ed rapidly with the temperature.

above table seemed to confirm the assumption that the effect of tion in a condenser is that of an added resistance in series with it, is is still further confirmed—taking into account the effect of rise of ature on absorption resistance—by some experiments performed with ndensers, each a ½ microfarad. For one, *A* was equal 3.144 ohms; he other was equal 7.116 ohms. Calculating from these two values he absorption resistances should be for the two condensers in series parallel, they are 10.26 ohms and 2.20 ohms, respectively. The tion resistances for the condensers in series and in parallel, as found ct experiment, in the two cases are 10.49 ohms and 2.79 ohms—hat larger than they should be, owing to the previous heating, but owing considerable agreement.

me Notes on the Zeeman Effect. By J. S. Ames, Earhart and H. M. Reese.

ur investigation of the effect of the magnetic field on radiations in er, we have been led to study certain variations from the phenomena red by Zeeman, which seem to be worthy of note. Up to the present e studied the effect of a magnetic field upon the spark-spectra of sium, iron, cadmium and zinc. The research is by no means combut having discovered several new effects we think it well to them at present, and to defer until later a full discussion of the nena.

apparatus has been the small concave grating of the Physical Labowhich has a radius of curvature of about eleven feet. The grating d with 15,000 lines to the inch and is five inches in width. The tic field has been produced by an ordinary form of electro-magnet, have made no attempt to measure the intensity of the field, because ject has not been to establish numerical relations. The field, howas strong enough to produce a separation in the case of iron of about of an Ångström unit, and the definition has been most satisfactory. ethod of use was to introduce between the spark and the slit a Nicol's and quartz lens, and to photograph the resulting spectra along the of the photographic plate, then turning the Nicol's prism through d at the same time turning a shutter which is placed in front of the raphic plate to expose the two edges of the plate to the new radiation through the Nicol's prism. By this method we secure on the same he components of the vibrations polarized along the lines of force right angles to them.

have studied the effect of the magnetic field upon the iron spectrum ave-length 3400 tenth metres to wave-length 4300, and in this region oticed that all the lines, with certain exceptions to be noted, are ind in the way discovered by Zeeman. In particular, when the radiaright angles to the magnetic field is studied, each line in the specbroken up into three, the central component being plane polarized, s vibrations along the lines of force; the two side components being olarized at right angles to this, their vibrations being at right angles ield of force.

have observed, however, that three lines, of wave-length 3587.13, and 3865.67, are affected in the opposite way; that is, the line is a when viewed at right angles to the magnetic field, but the central component is so polarized that its vibrations are at right angles to the field, and the two side components have their vibrations along the field.

Four lines, at 3746 06, 3767.34, 3850.12, 3888.67, have, so far as our indications go, no modification produced whatever. The lines at 3722.72 and 3872.64 are so modified as to be quadruplets, the central component which has its vibrations along the lines of force being a close double. There are several other lines concerning which we have doubt, but most of the others examined are clearly modified in the way described by Zeeman. We have noted too that the separation of the side components of the triplets seems to be most irregular; lines whose wave-lengths differ by only a few Ångström units have displacements which differ by 20 per cent. at least. In short, there seems to be no regularity in the separations produced. (Several of the above effects have been observed by other investigators.)

In studying the spectrum of cadmium we have observed that the lines at 4678.37, 4800.09, 5086.06, which belong to the "second subsidiary series," and the lines at 3467.76 and 3613.04, which belong to the "first subsidiary series," are all modified in the normal manner; that is to say, in the manner described by Zeeman, and by amounts which are no greater than for iron, but that there seems to be no regularity in the separations produced, either between the two series or between the lines of any one series.

We have been unable to extend our investigation into the extreme ultra violet owing to the fact that the Nicol's prism which we used in order to separate the components, absorbs the waves beyond 3400.

In the study of the spectra of zinc and of magnesium, we have not yet obtained results which are worthy of note.

The Effect of Alternating Current Wave-Forms on Transformer Losses. By Louis Duncan, W. L. Hodges, F. B. Keidel, and E. Frank.

The currents represented by waves of different shapes, as shown in the figures, were obtained by superimposing a third harmonic upon a fundamental wave. This was effected by joining "in series" two dynamos connected by a chain running on sprocket wheels so proportioned as to give the third harmonic relation. By changing the fixed position of one of the sprocket wheels, the third harmonic could be superimposed in any position.

The two machines used were an eight-pole Siemens alternator, running at a speed of 540 revolutions per minute, generating an alternating current of 36 cycles per second, and a bi polar continuous current machine made by the United States Company. The armature and brushes of the continuous current machine were revolved at such a speed as to give an alternating current of 12 cycles per second.

A Westinghouse (No. 8) transformer was used. The transformer was designed for a current of 8000 cycles per minute.

The secondary consisted of four coils; and a difference of potential of 1050 volts across the primary terminals produced a difference of potential of 100 volts across the secondary terminals. In the experiment the four coils of the secondary were connected in series.

The watts consumed were measured by an electro-dynamometer calibrated as a wattmeter. The "idle current" was measured by a low-reading Thompson alternating ammeter.

The instantaneous values of voltage and current were obtained by the instantaneous contact method, using calibrated electro-dynamometers.

In the curves shown the degrees refer to the zero point of the fundamental wave, the position of which was not changed.

Eight curves of different shapes were obtained, the third harmonic being advanced 15° in each case (with an advance of 120° the curves repeat themselves). A sine wave (No. 9) was also used.

No. of Curve.	1	2	3	4	5	6	7	8	9
Idle Current (amp.)............	.565	.625	.645	.655	.655	.615	.574	.545	.650
Watts consumed (true watts).....	13.5	14.5	16.5	18.35	19.5	18.25	17.5	15.0	17.0
Remarks............	Peaked.				Flat.				Sine.

Consider in the plane a fixed point O and a straight line OM (Fig. 1); suppose that when the point M describes the line OM, the needle MD remains parallel to itself, but when the line OM turns around O, the needle MD revolves twice as fast around its center M; the magnetic field thus defined is a circular field and the point O is its *center* or *pole*. To prove this, we can make use of the following property of this field: whenever the needle is displaced in the field in such a way that its center M describes a circle passing through the point O, the displacement of the needle will be precisely the same as if the needle were rotated around the center C of this circle. For, let M and M' be any two positions of the point M on the circle, and MD, $M'D'$ the corresponding positions of the needle; according to the definition of the field the angle between MD and $M'D'$ is twice the angle MOM', but the angle at the centre MCM' is also twice the inscribed angle MOM'; hence if the needle MD be rotated around C it will sooner or later take the position $M'D'$. But M' is any point of the circle, hence, during the whole circular displacement the needle remains in the field. If we take now any two positions of the needle in a circular field such as MD and $M'D'$, we can always pass a circle through the points M, M' and O and if the needle be rotated around the center C of this circle, it will not leave the field and will pass through the two given positions MD and $M'D'$; but between any two positions of a plane body there exists but one circular displacement. We see then that the circular field is such that the circular displacement determined by any two positions of the needle belongs to the field, and further that this circular displacement always passes through the pole of the field.

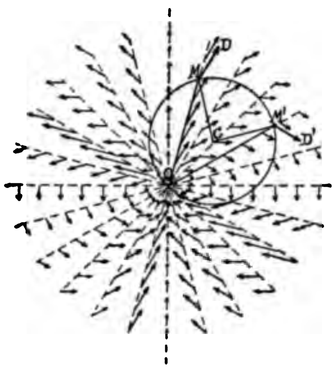

FIG. 1.

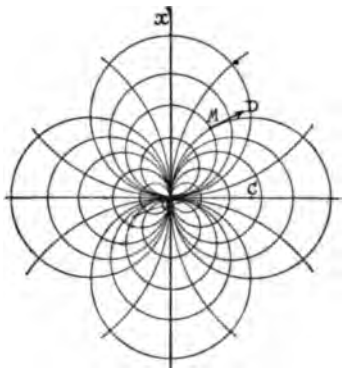

FIG. 2.

To determine the lines of force of a circular field, let MD be any position of the needle in the field (Fig. 2); draw a circle tangent to the line D and passing through the points M and O. When M describes this circle, MD turns around the center C of this circle, hence MD remains tangent to the circle, i. e.: this circle is the line of force passing through M and it is easy to see that all lines of force are circles passing through the pole O and tangent to the same line OX. By turning these lines of force of a right angle around the center O, we get a second system of circles, which cuts the first orthogonally.

I happened to speak of this circular field to Mr. Ed. Gallaudet, instructor of physics in Yale University, and he remarked to me that this field has the same lines of force as a field produced by an infinitely short magnet placed at the center O in the direction OX. It is remarkable that we have been led to the consideration of this field by relations purely geometrical, involving no principle of physics, much less the law of the inverse of the square of the distance, which is assumed in magnetism.

The circular field can be used in the study of any other field just as the plane is used in the study of surfaces. For instance, it takes three points to determine a plane in space; in the same way, it takes three positions of the needle to determine a circular field: let MD, $M'D'$, $M''D''$ be these three positions; the two positions MD and $M'D'$ determine a certain rotation and the positions MD and $M''D''$ determine another rotation; the circles MM' and MM'' described by M during these rotations intersect at M and at a second point O. This point is the pole of the circular field passing through the three given positions, because it contains two circular displacements passing through these positions.

The two positions $M'D'$ and $M''D''$ determine a third rotation which must belong to the same field, i. e.: the circle $M'M''$ described by M in this third rotation must also pass through O. But the rotation which brings the needle from the position $M'D'$ to the position $M''D''$ is the resultant of the two rotations ($M'D'$, MD) and (MD, $M''D''$). We see then that two rotations of a plane body determine a circular field which contains also the resultant rotation, and this remark leads to the law of composition of two finite rotations in a plane. Let ω be the angle of the first rotation, ω' that of the second and c, c' the centres of the rotations; give to any point m of the plane the rotation ω around c, this will bring m somewhere in m'; give to m' the rotation ω' around c', and let m'' be the final position of m'; the circles mm' and $m'm''$ determined by these rotations intersect in m' and in a second point o, which is such that the circle mom'' will determine the center of the resultant rotation, and the arc mm'' the angle of this resultant.

Being given a surface in space and three points on this surface not far from each other, the plane passing through these three points is a plane tangent to the surface, i. e.: a plane which coincides with the surface in the vicinity of the three points. In the same way, being given any magnetic field and three positions of the needle, not far from each other, these three positions determine a circular field *tangent* to the given field, i. e.: a circular field which can be substituted to the given field in the vicinity of the three positions; the circular lines of force of this tangent field will coincide very nearly with the real lines of force of the given field in the same vicinity. Now, if we were to place an infinitely short magnet at the pole of this tangent circular field and place the needle near the point of contact of the two fields, the effect produced by this magnet would be the same as the effect produced by all the magnets, which may be in the given magnetic field, since the two fields coincide near their point of contact. Hence, the resultant magnetic action at any point of a magnetic field, is the same as would be produced by a single short magnet placed at the pole of the circular field tangent to the given field at this point.

Another fundamental property of circular fields is that the intersection of two circular fields is always a circular displacement and this theorem corresponds in space to the fact that the intersection of two planes is always a straight line. Let O and O' be the poles of two circular fields and MD a position of the needle common to both fields; if we draw a circle through O, O' and M and let MD turn around the center of this circle, it is evident that during the whole rotation the positions of the needle belong to both circular fields. Three circular fields have only one position of the needle in common, which is determined by taking the intersections of the fields two and two; this will give three circular displacements passing through the same position.

These remarks are sufficient to show the use of circular fields in the study of any irregular field in a plane; I shall develop the subject and use circular fields in the study of motion of a plane body just as planes are used in space in the study of a twisted curve. I also hope to extend the theory to magnetic fields on a sphere and to any magnetic field in space; but this is all I can submit to you for the present.

Very respectfully yours,

RENÉ DE SAUSSURE.

AN ENCOURAGING VIEW OF AMERICAN CITIES.

(*Abstract of a Lecture given to Students of Historical and Political Science, at the Johns Hopkins University, by* TALCOTT WILLIAMS, *Editor of The Press, Philadelphia.*)

Mr. Williams began his address by a general comparison of American and European cities. In making the comparison, not magnificence but the comfort of the citizens should be considered. The first element of comfort is room. The population of the average American city is distributed over much more ground than that of the average European city, necessitating, therefore, a greater expense for paving, for lighting and cleaning the streets and for water and sewage facilities. Also, a greater variableness in meteorological conditions produces for American cities peculiar problems. The rain-fall, for example, is greater, the entire rainy period less, and during this period there is a greater irregularity of rain-fall than in Europe. The reason why the sewers of Berlin or London never break, as is sometimes the case in Philadelphia, is that in these cities it never rains hard enough to break a sewer.

Again a greater variation of temperature presents to American cities peculiar difficulties. For example, an asphalt pavement is sure to deteriorate faster under a swing of 160 degrees of temperature than under a swing of 100 degrees as is the case in northern Europe. To meet these meteorological extremes, a better grade of work, and therefore a greater expense, is necessary. Moreover, the death rate among children is increased by the high temperature of summer, and the pulmonary diseases peculiar to the winter climate of America increase the death rate still further by cutting life short at the other end. Therefore, American cities must necessarily neglect magnificence. In comparing them with European cities, not magnificence but the difficulties overcome and the relative comfort of the citizens must be considered. American cities do not choose to have a fountain in every square but choose rather to have a bath-tub in every home.

The growing influence of universities upon the life of the people shows the almost imperceptible yet certain development of higher institutions in American society. Some universities, like Columbia, on account of their liberal endowment, have long been segregated and apart from the people. But other universities, like the University of Pennsylvania, have had the good fortune to be born poor. This university has grown only by the interest taken in it by the people of Philadelphia and of Pennsylvania. In return, it has ever had in mind its obligation to the people in whose midst it stands. The university has become a part of the city and the city a part of the university. Its interests, however, extend beyond the city. Throughout the state, to social clubs, to organizations for educational purposes, wherever the people desire instruction, the university sends its representatives.

The original gift of land from the city was twenty six acres, subsequently increased by thirteen acres. The city has invested large amounts in scholarships of the University of Pennsylvania, of Bryn Mawr, and of minor institutions. The present educational facilities in Philadelphia are such that the humblest laborer, if able to keep his child in clothing, may see his son, without being at any expense for tuition, start in the kindergarten and go to the end of as good a legal course as the country affords or may see his daughter advance from the same beginning and become a graduate of Bryn Mawr.

In regard to the finances of the University of Pennsylvania, Mr. Williams said: There are about 7000 men in eastern Pennsylvania, 4000 of whom are in Philadelphia, who aid the university with their means. In it, also, many private corporations have an active interest. But the most valuable ally of all is the State of Pennsylvania. About every two years, the representatives of the university go to the legislature and ask for $200,000 and the money is obtained. Thus the "city of homes" and the State of Pennsylvania, hand in hand with the state's great university, are developing in a population, originally blown like a sand dune across the Atlantic, a unified institutional life.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

See page 47.

Philological Association.

One hundred and sixty-second regular meeting. December 17, 1897.

Papers read:

The Influence of Laurence Sterne on German Literature, by T. S. Baker.
Grammatical and Etymological Notes, by M. Bloomfield.

One hundred and sixty-third regular meeting. January 21, 1898.

Papers read:

On the Genesis of the Polychrome Bible, by P. Haupt.
A Scholar's Mistakes, by W. H. Browne.

One hundred and sixty-fourth regular meeting. February 18, 1898.

Papers read:

The English of Tennyson's In Memoriam, by H. E. Shepherd.
Observations in Juvenal and Martial, by H. L. Wilson.

Historical and Political Science Association.

December 3.

Impressions of Geneva, by J. M. Vincent.
France under the Third Republic, by C. W. Paine.
France under Louis XIV, by H. Campbell.
Social Transformation of England, by E. J. Benton.
Absolutism in American Government, by G. E. Barnett.
Nomination for Elective Offices, by L. F. Schmeckebier.
Historic Prophecy, by C. C. Weaver.

December 17.

Impressions of Berlin, by Sidney Sherwood.
Christianity and the Labor Conflict, by E. A. Smith.
Heinrich von Treitschke, by G. L. P. Radcliffe.
Fiske's "Old Virginia and Her Neighbors," by C. W. Sommerville.
The Popular Mind, by J. J. Cantey.
Zimmerman's "Universities in the U. S.," by T. S. Adams.
Machiavelli, by W. T. Thom.

January 7.

Impressions of Munich, by T. S. Baker.
John Randolph of Roanoke, by C. W. Sommerville.
Zwiedineck-Südenhorst's "Deutsche Geschichte," by L. F. Schmeckebier.
Cid Campeador, by St. G. L. Sioussat.
Border Wars of New England, by P. L. Kaye.

January 21.

Intervention of the United States in Cuba, by J. H. Latané. (Published in North American Review, March 1898.)
Rogers' "Interpretation of History," by W. E. Schloegel.
Europe in Africa in the Nineteenth Century, by D. E. Motley.
Bryce's Views on the Annexation of Hawaii, by J. R. Ewing.

February 4.

The Colonial Executive before the Restoration, by P. L. Kaye.
Political and Social Science in Modern Education, by Robert Garrett.
Haskins on Mediaeval Student Life, by G. L. P. Radcliffe.

February 18.

The United States Legal Tender Acts, by St. G. L. Sioussat.
Postal Savings Banks, by C. H. Brough.
Bryce's "Impressions of South Africa," by W. S. Myers.
Justin Winsor, by C. W. Sommerville.
Marsiglio of Padua and William of Ockam, by C. Snavely.
The National Banking System, by G. E. Barnett.
Revival of French Universities, by L. F. Schmeckebier.

March 4.

Constitutional Amendment and a New Federal Convention, by James Schouler.
Corporation Finance, by H. Campbell.
Nullification and Secession, by E. J. Benton.
War of Greek Independence, by P. L. Kaye.
Civil War and Reconstruction, by J. J. Cantey.

PUBLIC MEETINGS AND SOCIAL ASSEMBLIES

Recently held in the University Buildings:

A meeting of the Archaeological Institute of America, Baltimore Society, in the Donovan Room, December 11.

Three musicales by the Johns Hopkins University Musical Association, in McCoy Hall, December 18, January 15, February 12.

Annual meeting of the American Folk-Lore Society, in the Donovan Room, December 28 and 29.

Meetings of the Baltimore Folk-Lore Society, in the Donovan Room, January 14 and February 25.

An illustrated lecture on new methods of instruction in Drawing, by Mr. J. Liberty Tadd, of Philadelphia, under the auspices of the Baltimore Country School for Boys, in Levering Hall, January 15.

The annual meeting of the Baltimore Society for the Suppression of Vice, in Levering Hall, January 20.

A meeting of the Bank Clerks' Association of Baltimore, in Levering Hall, January 21.

Meeting of the Friendly Visitors of the Charity Organization Society, in Levering Hall, January 25.

Meetings in connection with the annual convention of the Young Men's Christian Associations of Maryland, West Virginia, Delaware and the District of Columbia, in Levering Hall, January 29 and 30.

An illustrated lecture on "Home Life in Pompeii," by Professor Morris H. Morgan, of Harvard University, under the auspices of the Archaeological Institute of America, in McCoy Hall, January 29.

A lecture, under the auspices of the Kindergarten Association of Baltimore, in Levering Hall, February 1.

A reception by the Young Men's Christian Association of the University in honor of President Patton, in Levering Hall, February 7.

A meeting of the Lawrence Memorial Association in Levering Hall, February 13.

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HOURS FOR LECTURES AND RECITATIONS, SECOND HALF-YEAR, 1897-98.

HOURS.	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
A. M. 9	Theory of Functions: Adv. (Craig.) Analytical Chemistry. (Morse.) Descriptive Astronomy. (Poor.) Italian: Elective. (Baxter.) German Readings. (Baker.) Electricity. (Duncan.) Geological Physics. (Reid.) Spanish: Elective. (Kuersteiner.) Trigonom.; Analytic Geom. (Cohen.) English Literature. (Greene.) Economic Sociology. (Sherwood.) Elocution. (Lee.) Latin Pro-Seminary. (Smith.) French: Elective. (Armstrong.)	Theory of Functions: Adv. (Craig.) Organic Chemistry. (Remsen.) Gen. Chem.: Minor. (Renouf & Randall.) Chemistry: Major. (Morse.) Latin Composition. (Wilson.) Italian: Minor. (Rambeau.) German Seminary. (Wood.) Mathematics: Major. (Hulburt.) Electricity. (Duncan.) Southern Hist. Conf. (Ballagh.) Historical Geology. (Clark.) French: Elem. (Kuersteiner.) Physiology: Major. (Dreyer.) Differential Equa. (Cohen.) (8 a. m.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Ricardo. (Hollander.) Aristotle. (Miller.) Roman Literature. (Smith.) Arabic Geographers. (Johnston.)	Organic Chemistry. Remsen.) Gen. Chem.: Minor. (Renouf & Randall.) Chemistry: Major. (Morse.) Horace. (Wilson.) Italian: Minor. (Rambeau.) Schiller's Dramas. (Wood.) Mathematics: Major. (Hulburt.) Electrical Seminary. (Duncan, Hering, Geer.) Historical Geology. (Clark.) Physiology: Major. (Dreyer.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Ricardo. (Hollander.) Debate. (Lee.) French Philology. (Armstrong.)	Theory of Functions: Adv. (Craig.) Organic Chemistry. (Remsen.) Gen. Chem.: Minor. (Renouf & Randall.) Chemistry: Major. (Morse.) Horace. (Wilson.) Italian: Minor. Rambeau.) German Seminary. (Wood.) Mathematics: Major. (Hulburt.) Electricity. (Duncan.) Geological Physics. (Reid.) French: Elem. (Kuersteiner.) Physiology: Major. (Dreyer.) Differential Equa. (Cohen.) (8 a. m.) Spanish: Minor. (Marden.) Theory of Credit. (Sherwood.) Aristotle. (Miller.) Hebrew Exercises. (Johnston.)	Math. Conference. (Craig.) Organic Chemistry. (Remsen.) Gen. Chem.: Minor. (Renouf & Randall.) Chemistry: Major. (Morse.) Horace. (Wilson.) Italian: Minor. (Rambeau.) German Seminary. (Wood.) Mathematics: Major. (Hulburt.) Electricity. (Duncan.) General History Exam. (Ballagh). French: Elem. (Kuersteiner.) Physiology: Major. (Dreyer.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Theory of Credit. (Sherwood.) Greek Composition. (Miller.) Latin: Elective. (Smith.)	Chemistry: Journal Meeting. (9-10.30.) Physical Seminary. (Ames.) Geology: Journal Club.
10	Greek Seminary. (Gildersleeve.) Light. (Rowland.) Physics: Minor. (Ames.) Osteology. (Andrews.) Electrical Measurements. (Hering.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10-5.) Latin Composition. (Smith.) German: Major. (Wood.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Herodotus and Greek Comp. (Miller.) Old Spanish Readings. (Marden.) Economics. (Hollander.) Historical Politics. (Vincent.) French Philology. (Armstrong.) German Literature. (Vos.)	Greek Syntax. (Gildersleeve.) Light. (Rowland.) Descriptive Astronomy. (Poor.) Trigonom.; Analytic Geom. (Cohen.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10-5.) French Phonetics. (Rambeau.) English Literature. (Greene.) Arabic Geographers. (Johnston.) Elocution. (Lee.) Historical Method. (Vincent.) German Readings. (Baker.)	Greek Seminary. (Gildersleeve.) Physics: Minor. (Ames.) Osteology. (Andrews.) Theoretical Astronomy. (Poor.) Theory of Numbers. (Cohen.) Elliptic Functions. (Chessin.) Zoology: Adv. (Brooks.) (10-5.) Plautus and Terence. (Smith.) German: Major. (Vos.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Arabic: Elem. (Johnston.) Spanish Philology. (Marden.) Economics. (Hollander.) Historical Politics. (Vincent.) Ovid, Vergil, etc. (Wilson.) Gothic. (Wood.)	Plato. (Gildersleeve.) Light. (Rowland.) Physics: Minor. (Ames.) General Biology. (Andrews.) Theoretical Astronomy. (Poor.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10-5.) Plautus and Terence. (Smith.) German: Major. (Wood.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Hebrew Exercises. (Johnston.) Spanish Seminary. (Marden.) Economics. (Hollander.) Historical Method. (Vincent.) Ovid, Vergil, etc. (Wilson.) German Literature. (Vos.)	Homer. (Gildersleeve.) Light. (Rowland.) Physics: Minor. (Ames.) General Biology. (Andrews.) Electrical Measurements. (Hering.) Theory of Numbers. (Cohen.) Zoology: Adv. (Brooks.) (10-5.) Plautus and Terence. (Smith.) German: Major. (Baker.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Biblical Antiquities. (Johnston.) Spanish Philology. (Marden.) Economics. (Hollander.) Ovid, Vergil, etc. (Wilson.) Gothic. (Wood.)	
11	German: Minor. (Wood.) Civilization. (Adams.) Roman Epigram. (Smith.) Psychology and Ethics. (Griffin.) German: Minor B. (Baker.) Theory of Functions: Elem. (Chessin.) Modern Dutch. (Vos.) French Dialects. (Elliott.) Strength of Materials. (Geer.) Mineralogy. (Mathews.) Public Law. (Willoughby.)	German: Minor. (Vos.) Civilization. (Adams.) Latin Seminary. (Warren.) Psychology and Ethics. (Griffin.) German: Minor B. (Baker.) Theory of Functions: Elem. (Chessin.) Assyrian Texts. (Johnston.) Romance Seminary. (Elliott.) Strength of Materials. (Geer.) Mineralogy. (Mathews.) Public Law. (Willoughby.)	English Drama. (Browne.) Roman Politics. (Adams.) Roman Topography. (Warren.) Psychology and Ethics. (Griffin.) Forensics. (Lee.) Physics: Jour. Meet. (Rowland & Ames.) Assyrian: Elem. (Johnston.) Modern Dutch. (Vos.) Romance Club. (Elliott.) Steam Engineering. (Geer.) Trigonom.; Analytic Geom. (Cohen.) Mineralogy. (Mathews.) English Literature. (Greene.)	German: Minor. (Vos.) Roman Politics. (Adams.) Latin Inscriptions. (Warren.) Psychology and Ethics. (Griffin.) German: Minor B. (Baker.) Hydrodynamics. (Ames) Steam Engineering. (Geer.) Theory of Numbers. (Cohen.) Mineralogy. (Mathews.) European History. (Vincent.)	German: Minor. (Vos.) Nineteenth Century. (Adams.) Latin Seminary. (Warren.) Psychology and Ethics. (Griffin.) German: Minor B. (Baker.) Hydrodynamics. (Ames.). Syriac. (Johnston.) Zool. Jour. Club. (Brooks & Andrews.) French Philology. (Armstrong.) Steam Engineering. (Geer.) Petrography. (Mathews.) European History. (Vincent.)	
M. 12	Physics: Major. (Ames.) Greek: Major. (Spieker.) French: Minor. (Rambeau.) Anglo-Saxon. (Bright.) English Constitution. (Lee.) Rhetoric. (Greene.) General Geology. (Clark & Shattuck.) Popular Latin. (Elliott.) French: Minor B. (Ogden.) Political Philosophy. (Willoughby.) Theoretical Mechanics. (Chessin.) Sanskrit: Elem. (Bloomfield.) Celestial Mechanics. (Poor.)	Physics: Major. (Ames.) Greek: Major. (Spieker.) French: Minor. (Rambeau) Shakespeare. (Bright.) English Constitution. (Lee.) Rhetoric. (Greene.) General Geology. (Clark & Shattuck.) Romance Seminary. (Elliott.) French: Minor B. (Ogden.) Political Philosophy. (Willoughby.) Elliptic Functions. (Chessin.) English: Major. (Browne.) Celestial Mechanics. (Poor.)	Physics: Major. (Ames.) Greek: Major. (Spieker.) French: Minor. (Rambeau.) Anglo-Saxon. (Bright.) Rhetoric. (Greene.) General Geology. (Clark & Shattuck.) Dante. (Elliott.) Physiology. (Howell.) French: Minor B. (Ogden.) American History. (Steiner.) Theoretical Mechanics. (Chessin.) Sanskrit: Adv. (Ness.) Celestial Mechanics. (Poor.)	Municipal Government. (Ballagh.) Latin: Elective. (Smith.) Italian: Elective. (Baxter.) Shakespeare. (Bright.) Elocution. (Lee.) English Literature. (Greene.) General Geology. (Clark & Shattuck.) Spanish: Elective. (Kuersteiner.) Physiology. (Howell.) French Criticism. (Ogden.) Economics. (Sherwood.) Physical Chemistry. (H. C. Jones.) Scientific German. (Baker.) Trigonom.; Analytic Geom. (Cohen.) Latin Jour. Club. (Warren.) (Alternate Thursdays.)	Physics: Major. (Ames.) Greek: Major. (Spieker.) French: Minor. (Rambeau.) Public Speaking. (Lee). Spanish Epic Poetry. (Marden.) Physiology. (Howell.) French: Minor B. (Ogden.) American History. (Steiner.) Physical Chemistry. (H. C. Jones.) Sanskrit: Elem. (Bloomfield.) English: Major. (Browne.) Hebrew at Sight. (Johnston.)	
P. M. 1	Calculus. (Hulburt.) English: Minor. (Browne.) Greek: Minor. (Spieker.)	Calculus. (Hulburt.) English: Minor. (Browne.) Greek: Minor. (Spieker.) Public Speaking. (Lee.)	Calculus. (Hulburt.) English: Minor. (Browne.) Greek: Minor. (Spieker.)	Calculus. (Hulburt.) English: Minor. (Browne.) Greek: Minor. (Spieker.) Herodotus and Greek Comp. (Miller.) Southern Econ. Hist. (Ballagh).	Economics. (Sherwood.) English Literature. (Greene.) Herodotus and Greek Comp. (Miller.) Scientific German. (Baker.) French: Elective. (Armstrong.) Elocution. (Lee.)	
2	Mechanical Drawing. (Geer.) Zoology: Elective. (Andrews.)	Mechanical Drawing. (Geer.) Drawing. (Whiteman.)		Drawing. (Whiteman.)		
3	Arabic Composition. (Haupt.) Hebrew Composition. (Haupt.) (3.30.) Mechanical Drawing. (Geer.) Zoology: Elective. (Andrews.) Old French Readings. (Armstrong.)	Compar. Hebrew Grammar. (Haupt.) English Seminary. (Bright.) Mechanical Drawing. (Geer.) Drawing. (Whiteman.)	Hebrew: Elem. (Haupt.) Old French Readings. (Armstrong.)	English Seminary. (Bright.) The Avesta. (Ness.) Drawing. (Whiteman.) Congressional History. (Hollander.)	History of Philosophy. (Griffin.)	
4	Compar. Philology. (Bloomfield.) Hebrew: Second Year. (Haupt.) Mechanical Drawing. (Geer.) Zoology: Elective. (Andrews.)	Lithuanian. (Bloomfield.) Ezra. (Haupt.) English Seminary. (Bright.) Mechanical Drawing. (Geer.) Drawing. (Whiteman.) Structural Geology. (Willis.)	Hebrew: Elem. (Haupt.) English Versification. (Bright.)	Comparative Grammar. (Bloomfield.) English Seminary. (Bright.) Economic Seminary. (Sherwood and Hollander.) Drawing. (Whiteman.) Structural Geology. (Willis.)	Vedic Seminary. (Bloomfield.) English Journal Club. (Bright.) (Alternate Fridays.) Political Conference. (Willoughby.) (Alternate Fridays, 4-6.)	
	Hebrew: Adv. (Haupt.)	Assyrian Seminary. (Haupt.)	Biblical Criticism. (Haupt.)	Economic Seminary. (Sherwood and	Historical Seminary. (Adams.)	Historical Conference. (Vincent.)

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NOTES FROM THE PHYSICAL LABORATORY.

EDITED BY JOSEPH S. AMES, PH. D.,

ASSOCIATE PROFESSOR OF PHYSICS AND SUB-DIRECTOR OF THE PHYSICAL LABORATORY.

: New Methods for the Measurement of Self
ınce, Mutual Inductance and Capacity. By H.
LAND and T. D. PENNIMAN.

American Journal of Science, December, 1897, and in *Phil. Mag.*,
1898, one of us published an account of a large number of new
'or the measurement and comparison of self-inductance, mutual
e and capacity. Several of these methods have been tested in the
Laboratory of the University with great success, notably the
or the *comparison* of the above quantities.

thods involve the use of the electrodynamometer with an alter-
rrent, and depend on one general principle—that is, that the de-
the hanging coil of an electrodynamometer, if the hanging coil
xed coils of the electrodynamometer are originally at right angles,
ional to the product of the currents in the hanging coil and the
, together with the cosine of the phase difference of the two cur-
ıe dependence of the deflection on the cosine of the phase differ-
e currents divides the methods into two general classes—methods
here is a deflection; i. e., the cosine of the phase difference has a
d methods of zero deflection, i. e., the cosine of the phase differ-
ıal to zero. The first class of methods gives the self-inductance
y in terms of resistance and b, i. e., 2π (the number of complete
ıs per second of the current). These methods were very easy of
n; the chief difficulty was the variation of b, as the current was
in the power house of the University, where the engine was sub-
at change of load. The presence of electric absorption also inter-
the accurate determination of the capacity of condensers. (See
BSORPTION, page 52).

owing method is an example of this class, and of the accuracy
h self-inductance can be determined even under these conditions.
ethod the fixed coils of the electrodynamometer are in the main
cuit, and the hanging coil is shunted off the main circuit around
sistance, r. In the hanging coil circuit is placed a non-inductive
R, with a self-inductance, L, under which condition the hanging
ıave a certain deflection when the current is flowing. They, R
now removed, and a non-inductive resistance, R^1, is substituted,
adjusted to give the same deflection as when R and L were in
Jnder these conditions,

$$b^2 L^2 = (R^1 - R)(R + r).$$

ethod and similar methods given in the article cited, values of
ances were determined that agreed among themselves to within
rt in 100; i. e., the determinations were made with about the same degree of accuracy as b could be determined, on which quantity they directly depended. Taking into account absorption, capacity can be determined by the same method with about the same degree of accuracy. This method is easy to use, as it requires but one adjustment, R^1.

The methods for the comparison of the above quantities gave much more accurate results, as they are independent of the period of the current, the great cause of error in the measurement of the quantities. When care was taken to guard against all inductive and electrostatic action of the different parts of the apparatus on each other, the results derived by the different methods tried were remarkably good, notably the results obtained by the method for the comparison of two self-inductances. The connections for this method are made in this manner:

Let there be two coils of self-inductances, B_1 and B_2 placed together, and let the circuit pass through the coil B_2. From the main circuit, after it has passed through the coil B_2, the hanging coil of the electrodynamometer, having in circuit a self-inductance, L, and a resistance, R, is shunted around a small resistance, r. The coil B_1 is placed in circuit with the fixed coils of the electrodynamometer and a resistance, R^{11}.

The condition, then, for zero deflection when the current is flowing is

$$\frac{L}{B_1} = \frac{R + r}{R^{11}}$$

Using this method and taking B_1 as a standard equal to 1 Henry, several coils were compared with B_1, both singly and in series. To show with what accuracy self-inductances of different amounts can be compared, a few values are given for two periods. The coils being compared with B_1 as a standard

	$n = 40$		$n = 133$		
COILS.	Results found by direct measurem't.	Sums and differences of direct measurem't.	Results found by direct measurem't.	Sums and differences of direct measurem't.	Sums and differences.
P_1	.5664	.5663	.5653	.5648	$(C + P_1) - C = P_1$
C	1.3050	1.3049	1.3034	1.3029	$(C + P_1) - P_1 = C$
$C + P_1$	1.8713	1.8714	1.8682	1.8677	$C + P_1$

These are good cases of agreement, and show the accuracy of the method for the comparison of self-inductances of different amounts, when care is taken to eliminate heating and electrostatic action of the resistance and leads.

It will be noticed that the value of the self-inductance for the two periods is different; this was due to the electrostatic action of the turns of the coils on each other, and therefore could not be avoided.

When equal self-inductances are to be compared, the accuracy depends only on the sensitiveness of the instrument to changes in $R+r$; and in the arrangement used in our experiments, the electrodynamometer was sensitive to changes of about 1 part in 10,000 in $R+r$. Therefore the construction of standard self-inductances that will agree with each other to within 1 part in 10,000 is feasible by this method.

Electric Absorption in Condensers. By H. A. Rowland and T. D. Penniman.

The theory of electric absorption and its effect on the capacity of condensers has been developed, and experiments have been carried out to test the theory and results. A short account of the theory was given in the *American Journal of Science*, December, 1897, but since that time a method for the direct measurement of the effect of absorption has been devised, and it is of interest to note the agreement of the results derived by two independent methods.

The condensers used in the experiments were constructed of parallel plates separated by paraffined paper or mica; that is, by a non-homogeneous medium; but Maxwell (El. and Mag., § 329) has shown that absorption is a necessary condition in a condenser whose surfaces are separated by a non-homogeneous medium.

Professor Rowland, starting with the formula as given by Maxwell, has developed the theorem for the case when the electromotive force is periodic, and has deduced the "correction" due to absorption. The formula is thus developed.

Since the insulating plates of the condenser are not homogeneous, they can be considered as made up of strata. The current through any stratum of thickness 1 cm. is

$$\bar{u}=\frac{X}{r_1}+\frac{1}{4\pi K_1}\frac{dX}{dt}$$

when $\bar{u}\equiv$ current per square centimeter.

$r_1\equiv$ specific resistance per unit of volume.

$K_1\equiv$ *inverse* of the dielectric constant.

$X\equiv$ electromotive force on the two sides of the stratum.

If the electromotive force is periodic,

$$X=X_1\,\epsilon^{ibt}$$

Where $b=2\pi$ (complete number of alternations per second). Substituting, we have

$$\bar{u}=\left(\frac{1}{r_1}+\frac{ib}{4\pi K_1}\right)X$$

$$\therefore\quad X=\frac{\bar{u}}{\frac{1}{r_1}+\frac{ib}{4\pi K}}$$

If there are several strata of different thicknesses, a_1, a_2, a_3, etc.,

$$X^1=\bar{u}\left(\frac{a_1}{\frac{1}{r_1}+\frac{ib}{4\pi K_1}}+\frac{a_2}{\frac{1}{r_2}+\frac{ib}{4\pi K_2}}+\text{etc.}\right)$$

where X^1 equal the sum of the electromotive forces on the strata. Expanding and collecting the terms, the equation reduces to the form:

$$X=\bar{u}\left(R+\frac{1}{ibc}\right)$$

where

$$R=\frac{B_0}{b^2}-\frac{B_2}{b^4}+\frac{B_4}{b^6}-\text{etc.}$$

$$\frac{1}{c}=A_0-\frac{A_2}{b^2}+\frac{A_4}{b^4}-\text{etc.}$$

the values of the constants being as follows:

$$B_0=\frac{a_1}{r_1K_1}+\frac{a_2}{r_2K_2}+\frac{a_3}{r_3K_3}+\text{etc.}$$

$$B_2=(4\pi)^2\left\{\frac{a_1}{r_1^3\,K_1^4}+\frac{a_2}{r_2^3\,K_2^4}+\text{etc.}\right\}$$

$$B_4=(4\pi)^4\left\{\frac{a_1}{r_1^5\,K_1^6}+\frac{a_2}{r_2^5\,K_2^6}+\text{etc.}\right\}$$

etc.

$$A_0=4\pi\left\{\frac{a_1}{K_1}+\frac{a_2}{K_2}+\frac{a_3}{K_3}+\text{etc.}\right\}$$

$$A_2=(4\pi)^2\left\{\frac{a_1}{r_1^2\,K_1^3}+\frac{a_2}{r_2^2\,K_1^3}+\text{etc.}\right\}$$

etc.

From the above it appears that a capacity having absorption acts in a circuit as a capacity with a resistance in series with it. The resistance is called "absorption resistance," and appears to vary with b, i. e. with the number of alternations. The capacity proper, i. e. c, will be independent of b if the number of alternations is great.

In the determination of the capacity of two condensers, 2 and 3 microfarads in parallel by Method I (see Note on the Measurement and Comparison of Self-Inductance, Mutual Inductance and Capacity), great variations were found in the deduced values of the capacity (using the ordinary formulae and treating a condenser as if it had capacity only), depending on the resistance in circuit and on the period, the variations being between wide limits, as is shown by the following example:

$n\equiv$ *number of complete alternations per second.*	$R\equiv$ *resistance in circuit with the condensers.*	$C\equiv$ *deduced value of the capacity.*
131.1	21.7	5.47
"	1021.7	4.51
53.3	21.7	6.38
"	1021.7	4.86
31.9	21.7	7.46
"	1021.7	4.92
14.	21.7	10.79
"	1021.7	4.87

But since the condensers possess absorption, and as the effect of absorption as shown in the formula above is that of an added resistance in series with a capacity, therefore the deduced values of the capacity for any particular period should be constant for all values of R, if the value of R is increased by a constant quantity A, the "absorption resistance," depending on the period. Doing this, and correcting the results of which the above are examples, a fair agreement is found for the "true" capacities for the periods used. In the tables below are collected the average corrected values of the capacity, together with n, and A the absorption resistance in ohms.

Capacity in microfarads.	4.94	4.96	4.96	4.64
n	131.1	53.3	31.9	14.
A *in ohms.*	5.19	20.5	34.09	139.62

In the table the capacity is nearly independent of n, except when $n=14$; but this may be caused by an error in determining n on which the capacity depends directly. A shows remarkable variation with n.

A, however, can be measured directly, and this was done for several condensers, including those used above, so that it was possible to compare two independent determinations of the same quantities.

The method for the direct measurement of absorption resistance involves the use of the Wheatstone bridge and an electro-dynamometer with an alternating current.

If the fixed coils of an electro-dynamometer are placed in one arm with a condenser, and if the hanging coil is placed in the cross connection of the bridge, and a periodic electro-motive force is applied to the terminals of the bridge, the condition that there is no deflection of the hanging coil is that

$$R_{\prime}R''=R'R_{\prime\prime}-\left(b^2lL_{\prime}-\frac{l}{C}\right)\frac{R''(R'+R'')}{R'(R''+R_{\prime\prime})+r(R'+R'')}$$

when $R_{\prime}\equiv$ resistance of arm with condenser.

$R', R'', R_{\prime\prime}\equiv$ resistance of the other arms.

$r\equiv$ resistance of the cross connection.

$L_{\prime}\equiv$ self-inductance of fixed coils of electro-dynamometer.

$l\equiv$ self-inductance of hanging coil of electro-dynamometer.

$C\equiv$ capacity of condenser.

Since $L_{\prime}$ is small, the formula reduces to the form:

$$R_{\prime}R''=R'R_{\prime\prime}+\frac{l}{C}\,\frac{R''(R'+R'')}{R'(R''+R_{\prime\prime})+r(R'+R'')}$$

The resistance $R_{\prime}$ was made up of the ohmic resistance of the arm of the bridge and the absorption resistance.

·mining $R_{\prime}$ by this method, and knowing its ohmic resistance, the
on resistance *A* was found. Using this method, for the condensers
ove, *A* was found for a few periods, and it can be seen from the
ınying table how the values determined by the two methods agree.

n	134.	131.1	57.6	56.6	53.3
ethod I.		5.19			20.5
ıeasurement.	5.30		21.6	22.2	

values as determined by Method I. should be somewhat less than
:termined by direct measurement. In Method I. there was practi-
heating, while in the method of direct measurement there was con-
e rise of temperature, due to the comparatively large current flowing
the condensers; and it was found that the absorption resistance
:d rapidly with the temperature.

ıbove table seemed to confirm the assumption that the effect of
on in a condenser is that of an added resistance in series with it,
ı is still further confirmed—taking into account the effect of rise of
ture on absorption resistance—by some experiments performed with
densers, each a $\frac{1}{3}$ microfarad. For one, *A* was equal 3.144 ohms;
ıe other was equal 7.116 ohms. Calculating from these two values
ıe absorption resistances should be for the two condensers in series
parallel, they are 10.26 ohms and 2.20 ohms, respectively. The
on resistances for the condensers in series and in parallel, as found
:t experiment, in the two cases are 10.49 ohms and 2.79 ohms—
at larger than they should be, owing to the previous heating, but
wing considerable agreement.

ıe Notes on the Zeeman Effect. By J. S. AMES, EARHART and H. M. REESE.

r investigation of the effect of the magnetic field on radiations in
:r, we have been led to study certain variations from the phenomena
·ed by Zeeman, which seem to be worthy of note. Up to the present
studied the effect of a magnetic field upon the spark-spectra of
um, iron, cadmium and zinc. The research is by no means com-
but having discovered several new effects we think it well to
them at present, and to defer until later a full discussion of the
ena.

pparatus has been the small concave grating of the Physical Labo-
which has a radius of curvature of about eleven feet. The grating
with 15,000 lines to the inch and is five inches in width. The
c field has been produced by an ordinary form of electro-magnet,
ıave made no attempt to measure the intensity of the field, because
:ct has not been to establish numerical relations. The field, how-
ıs strong enough to produce a separation in the case of iron of about
of an Ångström unit, and the definition has been most satisfactory.
:hod of use was to introduce between the spark and the slit a Nicol's
ıd quartz lens, and to photograph the resulting spectra along the
of the photographic plate, then turning the Nicol's prism through
at the same time turning a shutter which is placed in front of the
aphic plate to expose the two edges of the plate to the new radiation
through the Nicol's prism. By this method we secure on the same
e components of the vibrations polarized along the lines of force
ight angles to them.

ave studied the effect of the magnetic field upon the iron spectrum
ve-length 3400 tenth metres to wave-length 4300, and in this region
ticed that all the lines, with certain exceptions to be noted, are in-
in the way discovered by Zeeman. In particular, when the radia-
ight angles to the magnetic field is studied, each line in the spec-
broken up into three, the central component being plane polarized,
vibrations along the lines of force; the two side components being
ılarized at right angles to this, their vibrations being at right angles
eld of force.

ave observed, however, that three lines, of wave-length 3587.13,
and 3865.67, are affected in the opposite way; that is, the line is a
hen viewed at right angles to the magnetic field, but the central component is so polarized that its vibrations are at right angles to the field, and the two side components have their vibrations along the field.

Four lines, at 3746 06, 3767.34, 3850.12, 3888.67, have, so far as our indications go, no modification produced whatever. The lines at 3722.72 and 3872.64 are so modified as to be quadruplets, the central component which has its vibrations along the lines of force being a close double. There are several other lines concerning which we have doubt, but most of the others examined are clearly modified in the way described by Zeeman. We have noted too that the separation of the side components of the triplets seems to be most irregular; lines whose wave-lengths differ by only a few Ångström units have displacements which differ by 20 per cent. at least. In short, there seems to be no regularity in the separations produced. (Several of the above effects have been observed by other investigators.)

In studying the spectrum of cadmium we have observed that the lines at 4678.37, 4800.09, 5086.06, which belong to the "second subsidiary series," and the lines at 3467.76 and 3613.04, which belong to the "first subsidiary series," are all modified in the normal manner; that is to say, in the manner described by Zeeman, and by amounts which are no greater than for iron, but that there seems to be no regularity in the separations produced, either between the two series or between the lines of any one series.

We have been unable to extend our investigation into the extreme ultra violet owing to the fact that the Nicol's prism which we used in order to separate the components, absorbs the waves beyond 3400.

In the study of the spectra of zinc and of magnesium, we have not yet obtained results which are worthy of note.

The Effect of Alternating Current Wave-Forms on Transformer Losses. By LOUIS DUNCAN, W. L. HODGES, F. B. KEIDEL, and E. FRANK.

The currents represented by waves of different shapes, as shown in the figures, were obtained by superimposing a third harmonic upon a fundamental wave. This was effected by joining "in series" two dynamos connected by a chain running on sprocket wheels so proportioned as to give the third harmonic relation. By changing the fixed position of one of the sprocket wheels, the third harmonic could be superimposed in any position.

The two machines used were an eight-pole Siemens alternator, running at a speed of 540 revolutions per minute, generating an alternating current of 36 cycles per second, and a bi polar continuous current machine made by the United States Company. The armature and brushes of the continuous current machine were revolved at such a speed as to give an alternating current of 12 cycles per second.

A Westinghouse (No. 8) transformer was used. The transformer was designed for a current of 8000 cycles per minute.

The secondary consisted of four coils; and a difference of potential of 1050 volts across the primary terminals produced a difference of potential of 100 volts across the secondary terminals. In the experiment the four coils of the secondary were connected in series.

The watts consumed were measured by an electro-dynamometer calibrated as a wattmeter. The "idle current" was measured by a low-reading Thompson alternating ammeter.

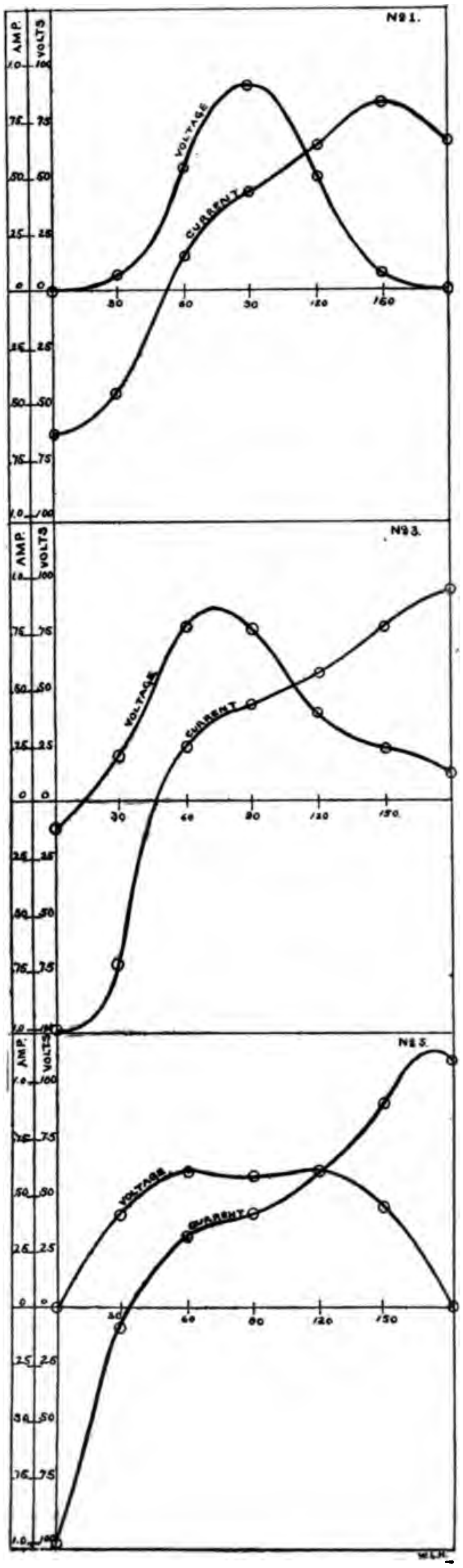
The instantaneous values of voltage and current were obtained by the instantaneous contact method, using calibrated electro-dynamometers.

In the curves shown the degrees refer to the zero point of the fundamental wave, the position of which was not changed.

Eight curves of different shapes were obtained, the third harmonic being advanced 15° in each case (with an advance of 120° the curves repeat themselves). A sine wave (No. 9) was also used.

NO. OF CURVE.	1	2	3	4	5	6	7	8	9
Idle Current (amp.)............	.565	.625	.645	.655	.655	.615	.574	.545	.650
Watts consumed (true watts).....	13.5	14.5	16.5	18.35	19.5	18.25	17.5	15.0	17.0
Remarks............	Peaked.				Flat.				Sine.

Above is a summary of the results obtained. By means of a standard voltmeter the potential across the terminals of the transformer was kept constant at 50 volts.



From the results given above, it is seen that the watts consumed by the transformer with the "peaked" wave (No. 1) are only 69.3 per cent. of those consumed by the "flat" wave (No. 5). The "idle current" is also much less in the case of the "peaked" wave.

The three sets of curves shown are the "peaked" wave (No. 1), the "flat" wave (No. 5), and an intermediate wave (No. 3).

A Recalculation of Griffiths' Mechanical Equivalent of Heat, based on Kahle's Determination of the Absolute Electro-Motive-Force of a Clark Cell and of the Electro-Chemical Equivalent of Silver. By F. A. Wolff, Jr., Ph. D., Office of U. S. Standard Weights and Measures, Washington, D. C.

The purely mechanical methods which have been employed for the determination of the mechanical equivalent of heat all give results agreeing with Rowland's original value within the probable limits of error. Recently Griffiths, and Schuster and Gannon, have obtained values by electrical methods differing appreciably from the mean of the above.

The only differences between the two methods, aside from the experimental details and the measurement of temperature, arise from the different methods of measuring the energy supplied to the calorimeter. This is measured directly in the mechanical methods, while in the electrical methods it is measured in terms of the absolute units of current, resistance, and electro-motive-force, which are based on the mechanical units.

All possible sources of error in both methods have been carefully scrutinized. Rowland's[1] thermometers have been compared with Tonnelot thermometers, which in turn have been compared with the nitrogen standard of the International Bureau. In addition, Rowland's thermometric scale has been compared with the platinum scale employed by Griffiths.[2] Eliminating all differences arising from different thermometric standards, the recalculated values of Rowland were found to differ from those of Griffiths by a constant amount of about 1 part in 400 at all temperatures, while the uncorrected values did not show a constant difference throughout the range of temperature employed.

While there is very slight possibility of an appreciable error in measuring the electrical quantities involved in Griffiths' determination in terms of the accepted standards of electro-motive-force and resistance, yet we are not sure that these standards are themselves correctly known. Therefore, at the Toronto meeting of the British Association, 1897, the Committee on Electrical Standards received an appropriation to redetermine the absolute electro-motive-force of the Clark cell and the electro-chemical equivalent of silver; and their results are anxiously looked for.

This redetermination has, however, recently been made at the Reichsanstalt by Dr. Kahle by means of an electro-dynamometer designed by the late Professor von Helmholtz.[3]

The Clark cell was kept at the temperature of melting ice during the experiment, and the relation between its E. M. F. at that temperature and at 15° C., the standard temperature, was also determined.

The value obtained for the German H-standard was

$$E_{15} = 1.4325 \text{ absolute volts.}$$

Fortunately, a direct comparison was made in 1892 between the Cambridge standard cell to which Griffiths' results are referred and the German standards. The results obtained by Dr. Kahle and Professor Glazebrook[4] showed that the Cambridge standard had an E. M. F. .0004 volts greater than the German standard.

Hence,

$$\text{Cambridge}_{15} = 1.4325 + .0004 = 1.4329 \text{ absolute volts.}$$

In Griffiths' determination the value assigned to the Cambridge standard was 1.4342, as determined by Glazebrook and Skinner.

The electro-motive force of the standard being taken too high, we obtain a value of J., the Mechanical Equivalent of Heat, too high; and to reduce we must multiply Griffiths' value by

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[1] Day, Univ. Circ., June, 1897.

[2] Waidner and Mallory, Univ. Circ., June, 1897. Note in this Circular, also.

[3] Zeitsch. f. Inst. k., Vol. 17, p. 144; Wied. Annal, Vol. 59, p. 532.

[4] B. A. Rep., 1892; Phil. Trans. A., 1892, p. 605.

$$\left(\frac{1.4329}{1.4342}\right)^1 = .99819$$

Correcting Griffiths' value for J. at 20° (4193.2×10^4) we obtain 4185.6.

The units of reference chosen by Schuster and Gannon[1] were those of current and E. M. F.

The value of *their* Clark cell was assumed to be 1.4340, and the electrochemical equivalent of silver was taken to be 1.118 mgs. per ampere per sec. No direct comparisons between their cell and the Cambridge standard have been recorded, but their results can be reduced to the above standard, assuming that their cell does not materially differ from the German standard.

Kahle found a difference of about 1 part in 1000 in the electro-chemical equivalent of silver, using fresh and old solutions. For fresh solutions he found the value 1.1182, taking the E. M. F. of a Clark cell 1.4325 as found by him.

Correcting Schuster and Gannon's result for J. at 20° C., 4191×10^4 ergs. we obtain

$$4191 \times \frac{1.4325}{1.434} \times \frac{1.118}{1.1182} = 4185.9$$

No allowance has been made for possible differences in standards of resistance, which can, however, introduce no great corrections, although it seems that the Reichsanstalt standard of resistance, the mean of a number of mercury standards, differs at present by .01 per cent. from the Cambridge International Ohm. *defined* by the relation

$$1 \text{ B. A. unit} = .9866 \text{ Int. Ohm.}$$

To summarize, the old and corrected values of the mechanical equivalent of heat at 20° C. are given below:

	Old.	*Corrected.*
Rowland..............................		$4183. \times 10^4$ mgs.
Griffiths..............................	4193.2	4185.6 "
Schuster and Gannon............	4191	4185.9 "

Another method of comparison would be to substitute Rowland's value in Griffiths' result and calculate the E. M. F. of the Cambridge standard.

This gives $E_{15} = 1.43245$ absolute volts,
against $E_{15} = 1.4329$ as determined by Kahle.
Diff. = .00045 = .03 per cent.

Kahle's value of the absolute E. M. F. of the Clark cell therefore seems to accord better with results obtained than the accepted value, 1.434 at 15. C.

Note.—One of Schuster and Gannon's Secondary Standards, No. 97, was compared in 1891 by Glazebrook and Skinner, with their own standards. The differences in electromotive-force found ranged between + .0027 volt and — .0017 volt; and hence no definite conclusions can be drawn as to the exact relation between Schuster and Gannon's standard cell and the Cambridge standard. (See *Phil. Trans.*, 1892, Vol. 183 A, p. 590).

The Energy Spectrum of an Absolutely Black Body.

By C. E. Mendenhall and F. A. Saunders.

In the Johns Hopkins *University Circulars* for June, 1897, we gave a preliminary note on the energy spectrum of a black body, as experimentally realized by a uniformly heated enclosure. This work has been repeated and extended with improved apparatus during the present year.

The form of body used was a hollow metal cylinder of length 17.5 cm., outside diameter 14 cm., and inside diameter 12.5 cm., with a vertical slit in its side 3 cm. high by 0.6 cm. wide, through which passed the energy to be measured. For low temperatures, up to 500° C., a double-walled body was used, between the walls of which a boiling liquid of suitable boiling point could be kept circulating, while for higher temperatures the body was made of half-inch grey cast iron and was mounted in a furnace of fire clay, heated by two blasts, one from above and the other from below. It is, of course, extremely important to produce a uniform temperature over the entire surface of the body, and by a suitable adjustment of the two blasts this ideal condition was nearly reached. The temperature was measured by means of platinum–platinum-iridium thermocouples which were inserted by means of two tubes entering the body from above; and readings were made at four points in the body, at two points near the top and bottom. An extreme variation of 30° C. was unusual, but occurred occasionally at the high temperatures, while as a rule the variation was about 15°; for the lower temperatures for which the furnace was used the variation was seldom 20°, and was generally about 10°, while when the body was heated by boiling liquids there was no perceptible variation. The alterations of temperature during the taking of a curve were usually very small, and in the high temperature work the curves were all repeated, and an average curve was taken, by which means it was thought that the effects of temperature variation were nearly eliminated.

The spectrometer slit was 1.5 mm. in width and produced, by means of a rock salt prism and lens, an image just covering the bolometer strips, which were 1 mm. in width and subtended at the axis of the instrument an angle of 5 minutes. The galvanometer was made especially for this work according to the Rowland pattern of Thomson four-coil instrument, and had a resistance of about 4 ohms; the magnet system used was made from ordinary watch hair-springs, the magnets being about 1 mm. in length and 8 in number, and the weight of the whole system, including the mirror, was 3.5 milligrams. This gave a deflection of 1 mm. at a distance of a metre for a current of $1.2.10^{-10}$ amperes and a complete period of 10 seconds. This sensitiveness was found quite sufficient, and gave for the higher temperatures a measurable deflection at a wave-length of 20 μ; but in the lower temperature work the system was never astatic enough to be at rest, even when the observations were made between three and five o'clock in the morning. The sensibility of the bolometer-galvanometer combination was tested by throwing in or out a small shunt in the bridge circuit and observing the deflection produced. In this way curves taken on different nights could be reduced to the same scale of sensibility.

The results show a shift of the maximum energy between the temperatures 1130° C. and 204° C. from 2.16 μ to about 5.0 μ, while the maxima for some of the other curves fall as follows: for 844° C., about 2.5 μ; for 554° C., about 3.1 μ, and for 292° C., about 4.4 μ. The curves not yet having been corrected for the impurity of the spectrum, however, these values can only be given as provisional; and the exact positions and amounts of the maxima are also difficult to determine owing to the fact that the absorption bands due to water vapor and to carbon dioxide falling at about 2.7 μ, and in our curves extending from 2.2 μ to 3 μ, cut off the tops of several of the high temperature curves. The carbon dioxide band at 4.3 μ, which extends from 3.6 μ to nearly 5 μ, disfigures in a similar manner the lowest curves obtained.

The curves drawn with galvanometer deflections as ordinates, and minimum deviations as abscissae, have been integrated to obtain the total radiation, and the results compared with the recent work of Lummer and Pringsheim (Wiedemann's Annalen, Jubilee Volume, Dec., 1897, p. 395), and with the formula of Stefan. Our results show on the whole a fair agreement with the formula:

$$\text{Total radiation} = C(T^4 - 292^4),$$

in which T is the absolute temperature and C a constant, although the radiation for the low temperatures is less than the formula would lead us to expect—a result which is in accord with the observations of Lummer and Pringsheim.

A Recalculation of Rowland's Values of the Mechanical Equivalent of Heat.

By C. W. Waidner and F. Mallory.

(Second Paper,—*in continuation of Note in Circular, No.* 130, *p.* 42.)

In order to account for the differences in the values of the Equivalent obtained by experimenters using the mechanical and electrical methods, the electrical methods apparently giving higher values, a comparison of the standards of thermometry used by the different observers was undertaken by the authors.

Rowland's temperature measurements were made with three Baudin thermometers (Baudin 6163, 6165, and 6166), which he had previously compared with an air thermometer. The temperature measurements upon which Griffiths' experiments depend, were made with platinum thermometers whose reduction to the air scale was known from a previous comparison of the platinum and air thermometer by Callendar and Griffiths; subsequently a Tonnelot thermometer standardized at the International Bureau of Weights and Measures was compared with the platinum air scale so that Griffiths was enabled to give his values on the Paris nitrogen scale. The experiments of Schuster and Gannon are based on the Paris nitrogen

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[1] Schuster and Gannon, Proc. Roy. Soc., Vol. 57, p. 25.

scale. Both Griffiths, and Schuster and Gannon, used electrical methods for the determination of the mechanical equivalent.

Shortly after the publication of the *University Circulars* for June, 1897, in which a short account of our comparisons was given, some further comparisons were made between Rowland's mercury thermometers and the Callendar-Griffiths platinum thermometer. A comparison of the platinum thermometer was then made, by Dr. W. S. Day and the authors, with a Tonnelot thermometer which had been standardized at the Bureau International, and whose indications could therefore be reduced to the Paris hydrogen and nitrogen scales. The results of this comparison are shown by curve A below, where ordinates represent the corrections to be added to the Callendar-Griffiths air scale to reduce to the Paris nitrogen scale. The agreement between these two scales, the former based on measurements made with a constant pressure air thermometer, the latter on measurements with a constant volume gas thermometer, is certainly as close as we have any reason to expect when we consider the difficulties of gas thermometry. The connection between the different scales of temperature (that of Rowland, Callendar-Griffiths, and Paris) was thus found, so that Rowland's values of the mechanical equivalent could be brought into comparison with those of Griffiths, and Schuster and Gannon.

The results of the comparison of these thermometers can best be shown by means of the following curves. Abscissae represent temperatures on the centigrade scale, and ordinates the corresponding corrections that must be added to Rowland's scale (air and absolute) to reduce to the Callendar-Griffiths, Paris nitrogen, or Paris hydrogen scales.

I. Rowland's air scale to Callendar-Griffiths' air scale.
II. Rowland's absolute scale to Callendar-Griffiths' air scale.
III. Rowland's absolute scale to Paris nitrogen scale.
IV. Rowland's absolute scale to Paris hydrogen scale.

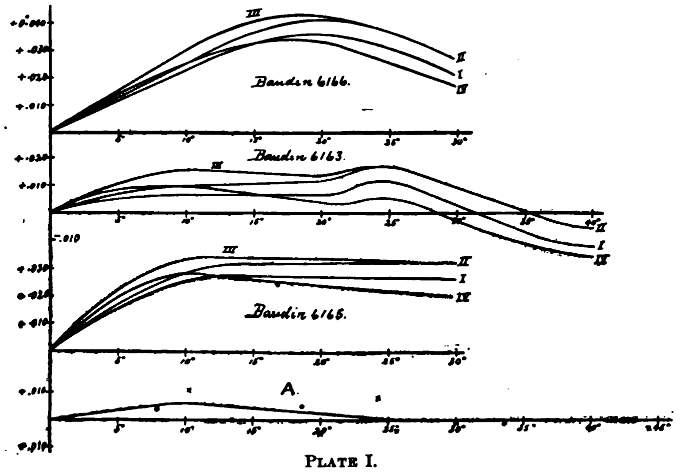


PLATE I.

The resulting changes in Rowland's values of the mechanical equivalent of heat, when these are reduced to the Paris nitrogen scale, are shown by the following curves.

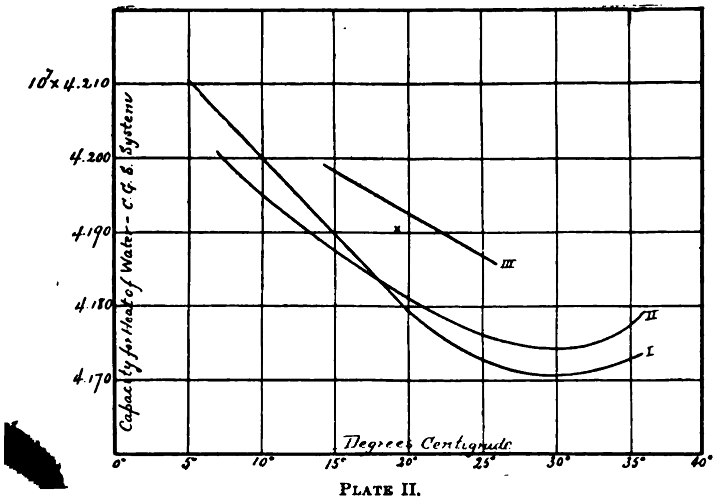


PLATE II.

I. Rowland—original Absolute Scale.
II. Rowland—reduced to Nitrogen Scale.
III. Griffiths—Nitrogen Scale.
X. Schuster and Gannon—Nitrogen Scale.

As will be seen from these curves, the changes in Rowland's values are small, amounting to a decrease of about 1 part in 800 at 10°C., the value at about 17° remaining unchanged, while those at 20° and 25° are slightly increased. For the sake of comparison, the results of Griffiths, and those of Schuster and Gannon, are also given. The variation of the specific heat of water with temperature between 15° and 25°, when Rowland's values are referred to the Paris nitrogen scale, is practically identical with that given by Griffiths' curve. This suggests at once that an explanation of the differences between the mechanical and electrical determinations of the mechanical equivalent must be sought in the energy measurements.

In Rowland's experiments an error in the energy measurements may be due either to an error in the diameter of the torsion wheel of his calorimeter or to the system of weights employed. Inasmuch as the diameter of the torsion wheel was measured many times by comparison with two standard metre bars, each of which had been compared with the Coast Survey and other standards, the possibility of an error sufficient to account for the observed differences between the mechanical and electrical determinations must be sought elsewhere. Turning to the question of the weights used in these experiments, we see that it is not necessary that they be correct absolutely with the standards, if they are only relatively correct, as the formula for the mechanical equivalent contains a weight in both numerator and denominator; on the other hand, if they were not correct relatively, we should hardly expect to find the almost constant difference between the determinations of Griffiths and those of Rowland (reduced to nitrogen scale) throughout the range 15° to 25° C. The evidence accumulated thus far would, we believe, suggest as a possible explanation of these differences a still undiscovered error in the system of electric units employed. This, indeed, in the light of the enormous and painstaking work which serves as the basis of these units, is not probable, but, considering the difficulties encountered in the standards of electromotive force and current, it is not altogether impossible. The enormous experimental evidence which served as the basis of the international ohm, together with the recent confirmation of the accuracy of this unit, renders it almost certain that the discrepancy need not be looked for in this direction. (See article by Dr. F. A. Wolff, in this Circular, page 54.)

Notes on the Concave Grating. By S. ALFRED MITCHELL.

GENERAL THEORY.

The general theory of the concave spherical grating has been investigated by Rowland (*Phil. Mag.*, Vol. XVI, p. 197, and *Amer. Jour. Sci.*, (3), 26, 1883); by Glazebrook (*Phil. Mag.*, Vol. XVI, 1883); by Mascart (*Jour. de Physique* (2) 2, 1883); and by Kayser (Winkelmann, *Handbuch der Physik*, p. 408).

The following treatment is one which, starting from a perfectly general condition, is true for every form of grating ruled with equal spaces. By introducing the condition that the ruled surface is a portion of a sphere, the general equation of the concave grating is obtained.

From the general theory of gratings (Rayleigh, "Wave Theory of Light," § 14, *Ency. Brit.*, p. 437) we know, if we have a grating ruled with equal spaces along the chord on any surface, that

$$\lambda = \frac{\omega}{N}(\sin\gamma + \sin\mu). \qquad (1)$$

where λ is the wave-length, ω the grating space, N the order of the spectrum, γ and μ the angles which the incident and diffracted light make with the normal to the surface at any point. This equation as developed by Rayleigh (loc. cit.) is deduced for parallel beams of light falling on a plane grating. Kayser (*Handbuch der Physik*) has shown that this holds also for a concave grating.

That is, if in Fig. 1 L is the radiant point, and if a cone of rays from L falling on the surface of the grating QoT at P is brought to a focus at L' by any means (if the grating is plane, a lens will be necessary), then λ is the wave length of the light which is brought to a focus at L'.

The above equation may be written:

$$(\sin\gamma + \sin\mu) = \frac{N\lambda}{\omega}. \tag{2}$$

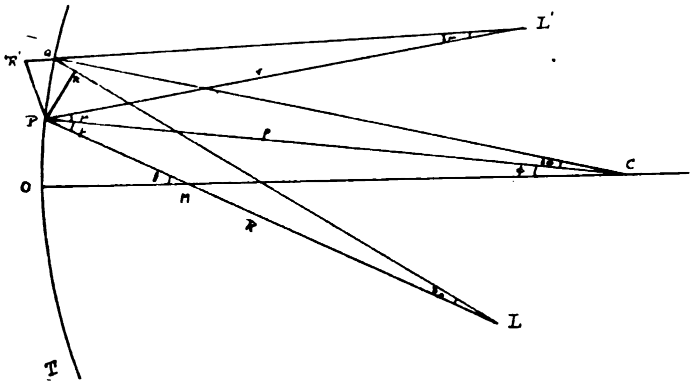


FIG. 1.

If now we allow the point P to move in the plane LoL', along the surface QoT, so that the angles which the incident and diffracted light make with the normal to the surface are now $(\gamma + \delta\gamma)$ and $(\mu + \delta\mu)$, then a new wave-length $(\lambda + \delta\lambda)$ will be brought to a focus at L' so as to satisfy the equation:

$$\sin(\gamma + \delta\gamma) + \sin(\mu + \delta\mu) = \frac{N\lambda}{\omega} + \frac{\delta(N\lambda)}{\omega}. \tag{3}$$

Developing by Maclauren's theorem, and subtracting (2) we get:

$$\cos\gamma\,\delta\gamma + \cos\delta\mu = \frac{1}{\omega}\,\delta(N\lambda) \tag{4}$$

in which we neglect quantities of an order higher than the first. Hence we get:

$$\cos\gamma\frac{d\gamma}{d\phi} + \cos\mu\frac{d\mu}{d\phi} = \frac{1}{\omega}\frac{d(N\lambda)}{d\phi}, \tag{5}$$

where ϕ is any independent variable.

This equation gives the change in wave-length due to a change in the angles of incidence and diffraction, L and L' remaining unchanged.

If now the grating surface is spherical—the case of Rowland's concave grating—let o be the centre of the grating, c the centre of curvature; cP is the normal to the surface at P, and the line cP is the radius of curvature ρ. Then the angle LPc is γ, $L'Pc$ is μ, and putting ocP and oMP equal respectively to ϕ and θ, we see:

$$\gamma = \theta - \phi;\ \mu = \theta' - \phi,$$

and hence

$$\frac{d\gamma}{d\phi} = \frac{d\theta}{d\phi} - 1;\ \frac{d\mu}{d\phi} = \frac{d\theta'}{d\phi} - 1. \tag{6}$$

Calling the distances LP and $L'P$ equal R and ν respectively, and letting fall perpendiculars PR and PR' on LQ and $L'Q$ respectively, we see that:

$$PR = \rho d\phi\cos\gamma = Rd\theta.$$

Hence

$$\frac{d\theta}{d\phi} = \frac{\rho\cos\gamma}{R},$$

and consequently,

$$\frac{d\gamma}{d\phi} = \frac{\rho\cos\gamma}{R} - 1;$$

and similarly

$$\frac{d\mu}{d\phi} = \frac{\rho\cos\mu}{\nu} - 1. \tag{7}$$

Substituting these values of $\frac{d\gamma}{d\phi}$ and $\frac{d\mu}{d\phi}$ in equation (5) we get:

$$\cos\gamma\left(\frac{\rho\cos\gamma}{R} - 1\right) + \cos\mu\left(\frac{\rho\cos\mu}{\nu} - 1\right) = \frac{1}{\omega}\frac{d(N\lambda)}{d\phi}, \tag{8}$$

which equation is true to terms of the order $d\phi$. Since this is the same equation as (5), it expresses the change in wave-length due to a change in the angle (ϕ) at the centre of curvature. To have a perfect focus at L', this change in wave-length due to a change in the angle ϕ must be zero, or in other words $\frac{d\lambda}{d\phi} = 0$. Light of wave-lengths which are whole multiples of λ will also be brought to the same focus L', since $\frac{d(2\lambda)}{d\phi} = 0$, $\frac{d(3\lambda)}{d\phi} = 0$, etc.

Hence, making $\frac{d(N\lambda)}{d\phi} = 0$, in (8) we have:

$$\cos\gamma\left(\frac{\rho\cos\gamma}{R} - 1\right) + \cos\mu\left(\frac{\rho\cos\mu}{\nu} - 1\right) = 0. \tag{9}$$

This may be put in the form:

$$\frac{\cos^2\gamma}{R} + \frac{\cos^2\mu}{\nu} = \frac{\cos\gamma + \cos\mu}{\rho}, \tag{10}$$

from whence we get:

$$\nu = \frac{R\rho\cos^2\mu}{R(\cos\mu + \cos\gamma) - \rho\cos^2\gamma}. \tag{11}$$

This is the equation of the curve on which the spectra are brought to a focus. In this the centre of the grating is the origin, the line passing through the centre of curvature is the axis of reference, R and γ are the coördinates of the source of light, ν and μ the coördinates of the focal line. This is the same equation as derived by Rowland.

It should be noted that if "Rowland's mounting" is used (see below), the terms of the second order which are omitted in equation (4), vanish of themselves.

ASTIGMATISM.

One of the properties of the concave grating which has helped to make it of such great value in scientific research is the property of astigmatism, in virtue of which a point source of light at the slit is brought to a focus, not in a point but in a line. We consequently get a wide spectrum which renders the determination of wave-lengths more accurate, and increases the accuracy with which we can compare metallic and solar lines.

Although this property has always been recognized, no formula giving the amount of the astigmatism has been published, at least to my knowledge. This is deduced in the following formulae:

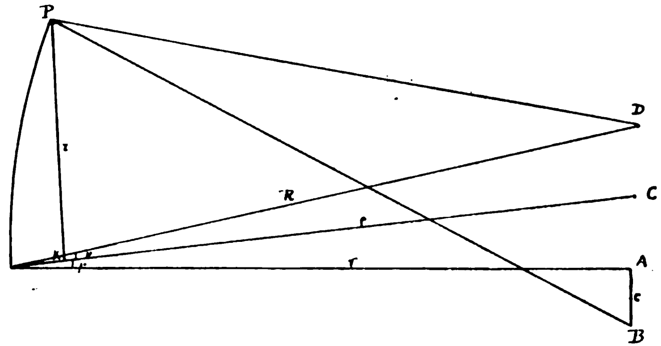


FIG. 2.

In Fig. 2 let D be the position of the point source of light at the slit, situated at a distance R from the centre of the grating O; AB is the spectral line under consideration, which will be parallel to the lines of the grating, and is situated at a distance r from the centre of the grating; C is the centre of curvature; CO is the radius of curvature ρ. AO and CO lie in a horizontal plane. Let PO be a vertical section of the grating; i. e., parallel to the lines of the grating. A small pencil of rays from the source D falling on the grating at O is brought to a focus at A, a small pencil from D falling on the grating at P is brought to a focus at B. It is our problem to find the length of AB, it being assumed that AB is perpendicular to OA.

Call $AB = c$, $PK = z$, where PK is the perpendicular let fall from P on the radius of curvature OC.

Since OK is a very small quantity compared with the other quantities considered:

$$OK = \frac{z^2}{2\rho} \quad\text{and}$$

$$AK = r - \frac{z^2}{2\rho}\cos\mu.$$

$$\overline{BP}^2 = \overline{AK}^2 + (\overline{KP} + \overline{AB})^2$$

$$= \left(r - \frac{z^2}{2\rho}\cos\mu\right)^2 + (z + c)^2.$$

If we neglect terms of a higher order than the second:

$$\overline{BP} = r - \frac{z^2}{2\rho}\cos\mu + \frac{z^2 + 2zc + c^2}{2r}.$$

Similarly we will have

$$\overline{DP} = B - \frac{z^2}{2\rho}\cos\gamma + \frac{z^2}{2R}.$$

But since the point of light at O, and the focal line AB are foci, the difference in paths of rays falling at P and at D must be zero. Hence

$$(AO + DO) - (BP + DP) = 0 \tag{12}$$

$$\text{i. e.} \quad z^2\left(\frac{\cos\mu}{2\rho} + \frac{\cos\gamma}{2\rho} - \frac{1}{2R} - \frac{1}{r}\right) - \frac{cz}{r} - \frac{c^2}{2r} = 0 \tag{13}$$

Solving, we get:

$$c = -z \pm z\sqrt{r\left(\frac{\cos\mu + \cos\gamma}{\rho}\right) - \frac{1}{R}}. \tag{14}$$

Twice this value will give us the length of the spectrum when we have a point source of light at the slit.

But in practice the illuminated portion of the slit, assumed parallel to the lines of the grating, is of some finite length $2b$, where b is the length of the slit above the horizontal plane. To find the length (c') of the lines of the spectrum due to this, we have merely to apply the ordinary equation for finding the magnification due to a concave mirror, which in this case gives us:

$$\frac{c'}{r} + \frac{b}{R} = 0,$$

$$\text{or } c' = -b\frac{r}{R}. \tag{15}$$

Adding this to the value from equation (14), we have for half the length of the special lines:

$$c_0 = c + c' = -z \pm z\sqrt{r\left(\frac{\cos\mu + \cos\gamma}{\rho} - \frac{1}{R}\right)} - b\frac{r}{R}. \tag{16}$$

Apply this to the special case where Rowland's mounting is used. In this case slit, grating and camera are at the vertices of a right-angled triangle, and hence:

$$r = \rho; \ R = \rho\cos\gamma; \ \mu = 0.$$

Substituting these values in the above equation, we get:

$$c_0 = -\frac{b}{\cos\gamma} - z \pm z\sqrt{1 - \frac{\sin^2\gamma}{\cos\gamma}}.$$

As a special case, let $r = 0$. The image of the slit coincides with the slit itself, and hence $C_0 = -b$; whence we see that the positive sign before the radical must be used.

Hence,

$$c_0 = -\frac{b}{\cos\gamma} - z + z\sqrt{1 - \frac{\sin^2\gamma}{\cos\gamma}}.$$

From this equation it is seen that the astigmatism depends only on the length of the illuminated portion of slit, the length of the ruled lines of the grating, and the angle which the source of light makes with the axis of the grating. Astigmatism is independent of the radius of curvature.

Measuring the length of the lines of the spectrum formed by the large concave grating used in this University, it was found that the observed and computed values agreed most satisfactorily.

Influence of Surrounding Dielectric on Conductivity of Copper Wires. By J. F. Merrill.

Respecting the question discussed by Sanford, Carhart, Grimaldi and Platonia, and others, it was thought that a comparative method of measuring both temperature and resistances would give more satisfactory results than an absolute method, such as Sanford and Carhart employed.

Accordingly, two copper tubes each 100.7 cm. long and 3.2 cm. diameter, and each provided with a mercury thermometer graduated to tenths of degrees, a platinum thermometer, and about 39 feet of polished copper wire, 1 mm. diameter, wound in a helix 1.9 cm. diameter, extending from one end of the tube to the other, were placed side by side within a double walled tubular water jacket made of zinc. The pieces of wire in these tubes were cut from the same spool, and were of almost equal resistances. One tube was to be filled with air only, and the resistances of its various contents were to serve as standards, with which were to be compared those of the other tube, which was to be filled in turn with various dielectrics. These tubes were side by side in an air column, which was surrounded by a water column 8.5 cm. thick and 120 cm. high. The inner tube of the water jacket enclosing the copper tubes and the air column was 8.4 cm. in diameter and terminated at the bottom in a funnel, the stem of which, 8 cm. long and 1.2 cm. diameter, projected 1 cm. below the flat bottom of the water jacket. Up through this stem and funnel passed a rubber tube which connected with the inside of the dielectric tube, and through which liquids and vapors could be run in or out at will without in any way disturbing either of the copper tubes.

The mercury thermometer bulbs extended in about 6 cm. from the top of the tubes and served only as preliminary indicators of temperature. The readings from these were not used in deducing results. Each platinum thermometer was made of 185 cm. of wire, .25 mm. diameter, doubled on itself and secured in a thin copper tube 9 mm. diameter and about 99 cm. long, which was fastened so as to pass lengthwise through the centre of the larger copper tube, but was insulated from it at both ends. Thus the platinum thermometer would indicate the average temperature of the tube in which it was placed. The copper helix, coiled about the smaller copper tube, was carefully insulated from it.

This helix was soldered to the cap at the bottom of the larger copper tube, but passed out through an insulating plug at the top. One copper tube and helix, or its platinum thermometer, formed one arm of a Jenkin bridge, while the other tube formed another. Connection was made with the bridge by means of heavy flexible cords terminating in rods, which were clamped to the bottom of mercury cups. The helix and one platinum terminal had a common lead from the tube to the bridge. Thus, to change from copper to platinum resistances, but one terminal at each side of the bridge had to be changed, together with the spool on which was wound the two fixed arms. These fixed arms, both for the platinum and the copper, differed by not more than 0.0003 ohms, the resistance of each arm for the copper resistances being about 0.30755 ohms at 27° C.—but little greater than the copper tube and helix. The air tube and helix and its platinum thermometer had slightly greater resistances than the corresponding ones of the dielectric tube; but a balance with the bridge was secured by shunting the greater resistance, using for this purpose standard plug boxes, a separate box for each; knowing the value of the shunt for each position of the bridge commutator and the value of the shunted resistances, the corresponding values of the dielectric tube could be calculated.

The water jacket was heavily wrapped with felt, and the bridge, shunt boxes, keys and galvanometer were enclosed in boxes and cases to prevent sudden changes of temperature in any part of the connections. The keys and commutators were operated by push rods and levers from the outside of the box. The galvanometer circuit was kept closed continuously, except during the instant of closing or opening the battery circuit, to avoid the disturbance due to thermal currents.

A careful determination of the temperature coefficient of each platinum thermometer gave, after annealing the wire, 0.00180. The coefficient for the copper tube and helix was 0.0037. After the tubes had stood in place several hours, surrounded by a nearly constant temperature water bath, measurements were made by means of a Queen's standard bridge, Anthony form, of the absolute resistance of the air tube and helix, and its platinum thermometer. The measurements gave for the tube and coil 0.27576 ohms, and for the platinum 7.3884 ohms at 22°.7 C. Observations were then taken at intervals during three days, water of nearly constant temperature running through the jacket night and day, to determine the difference between the resistances of the two tubes and their coils. The values for the second tube, air being the dielectric, were found to be 0.274279 and 7.37513 for copper and platinum respectively.

Kerosene at about the temperature of the bath was then run into the dielectric tube by the method indicated above, and measurements at intervals during three more days were made to determine the resistances. The observations during the second and third days are here given, those of the first day being equally good.

Let R' be shunt value when commutator was in one position, and R'' the value when in the other position; T, temperature in box enclosing bridge; T_1, temperature of air tube as given by mercury thermometer, and T_2, temperature of dielectric tube; R, the resistance deduced from the observations. The observations are here given in the order taken. To change from copper to platinum the bridge terminals were changed, as above indicated.

Date.	*Hr.*	T	T_1	T_2	R'	R''	R	
Aug. 10	*A. M.*				*Pt.*			
	10:55	24.4	22.59	22.59	4255 4250 4240	3880 3875 3880	7.37495	
					4248	3878		
					Cu.			
	11:15	24.4	22.60	22.60	51.7 51.32 51.70 51.55	49.29 49.33 49.50 49.45	0.274264	(A)
					51.56	49.4		
	P. M.				*Cu.*			
	3:10	24.4	22.65	22.65	51.9 51.63 51.86	49.78 49.38 49.66	0.274268	
					51.8	49.6		
					Pt.			
	3:45	24.4	22.65	22.65	4260 4260	3890 3885	7.37500	(B)
Aug. 11	*A. M.*				*Cu.*			
	8:00	23.6	22.3	22.3	52.45 52.26 52.00 51.96 51.85	50.33 50.24 50.00 50.10 50.10		
					52.1	50.15	(1)	
					Pt.			
	8:40	23.7	22.35	22.35	4325 4320	3945 3935 3935		
					4322	3937	(a)	
					Pt.			
	10:10	23.8	22.4	22.4	4340 4335	3950 3945		
					4337	3947	(b)	
					Cu.			
	10:20				51.85 51.85 51.90 51.70 51.90	50.5 50.3 50.5 50.2 50.3		
					51.84	50.36	(2)	
					Cu.			
	11:00	23.8	22.4	22.4	52.4 52.4	50.85 50.75		
					52.4	50.8	(3)	
					Pt.			
	11:05				4370 4360 4360	3975 3970 3965		
					4363	3967	(c)	
Aug. 11	*A. M.*				*Cu.*			
	11:18				52.3 51.9 52.0 52.6 52.0	50.48 49.65 50.1 49.7 50.0		
					52.16	50.0	(4)	
	P. M.				*Cu.*			
	3:35	23.8	22.4	22.4	52.00 52.25 52.5 52.6 52.3	49.65 50.2 50.55 50.25 49.9		
					52.33	50.11	(5)	
					Pt.			
	3:55				4325 4310 4300 4300 4300	3950 3945 3930 3925 3920 3920		
					4307	3931	(d)	
					Cu.			
	4:15	23.9	22.4	22.4	51.4 51.5 51.6 52.0 51.75	49.85 49.50 49.8 49.4 49.75		
					51.65	49.66	(6)	

From set of observations (A) the platinum resistance in the dielectric tube is 0.00018 ohms less than the air value, corresponding to 0°.015 C. The copper resistance is 0.274264, but corrected for 0°.015 C. it is 0.274279, the exact air value. Correcting (B) in same way the result is 0.274278, same as in air.

The mean of (1, 2, 3, 4, 5, 6) gives $R' = 52.1$ and $R'' = 50.2$, from which is obtained 0.2742805 for R.

Mean of (a, b, c, d) gives $R' = 4332$ and $R'' = 3945$, from which is obtained for R 7.37520 ohms.

Now these values are almost identical with those obtained with air in the dielectric tube, the copper being 0.0000015 ohms greater and the platinum 0.00007 ohms greater, which corresponds to 0°.005 C. This would give for copper corrected 0.274285, an increase of 0.002 per ct., according to these observations.

Now for a copper connection a change of one ohm in R' corresponds to a possible resistance change of about 0.000025 ohms in the dielectric tube and helix. But a change of one ohm caused a galvanometer deflection of 22 scale divisions; hence a deflection of 1 scale division would be caused by a resistance variation of one millionth of an ohm. With the platinum where $R' \equiv 4350$ ohms, a change of five ohms would correspond to 0.00002 ohms, i. e., to about 0°.0016 C.

Sanford reported a *decrease* of resistance in kerosene of 0.18 per cent., which would correspond in the tube and wire here used to 0.00049 ohms. The sensibility of the galvanometer in these measurements was such that it seems if there had been a change of even 0.00001 ohm, or one-fiftieth of Sanford's percentage change, it certainly could have been detected. And notwithstanding the variations in the shunt resistances as given above the extreme difference corresponds only to 0.000015 ohms. But these variations were undoubtedly due mostly to variable commutator- and terminal-contacts.

Tests were made with other dielectrics and on another sample of wire of the same size with the following results. Let C_1 be first wire and C_2 the the second.

Dielectric.		*Possible Change less than*
Kerosene	C_1	+ 0.002 per ct.
Absolute alcohol	C_1	— 0.001 per ct., 1st test. — 0.001 per ct., 2d test.
	C_2	+ 0.008 per ct., 1st sample alcohol (not pure). + 0.002 per ct., Squibbs' alcohol.
Absolute alcohol vapor	C_1	+ 0.01 per ct., possibly, not probably, 1st test. + 0.009 per ct. possibly, not probably, 2d test.
Ether vapor	C_1	— 0.006 per ct., 1st test. + 0.002 per ct., 2d test.
	C_2	+ 0.003 per ct.
Gasoline vapor	C_2	— 0.005 per ct.
Benzine (petrolic ether)	C_2	+ 0.005 per ct.
Benzine vapor	C_2	— 0.002 per ct.
Chloroform vapor	C_2	+ 0.002 per ct.

With the apparatus used the experimental error is not greater than 0.01 per ct. And it is fair to say that outside the limits of experimental error the dielectric does not change the conductivity. With slight modifications the method is capable of still greater accuracy.

The above work was begun in Baltimore and completed in the Ryerson Laboratory of the University of Chicago.

The Effect of Fibrous Structure in Iron on its Change in Length when Magnetized. By E. Rhoads.

The experiments described in this paper have for their object the determination of the effect which the grain, or fibrous structure of sheet iron, exerts upon its changes in length due to magnetization. Strips 3 x 91.5 cm. were cut from a long sheet of transformer iron 0.035 cm. thick, parallel with, and at right angles to, its length. These were bent into tubes around a bar, and measurements were made of the changes in length of each when subjected to a uniform magnetic field in the direction of its length. The accompanying magnetization was also measured.

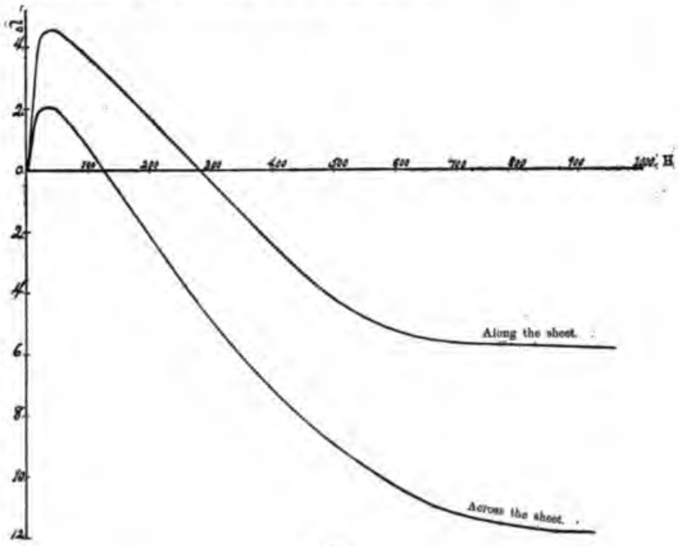
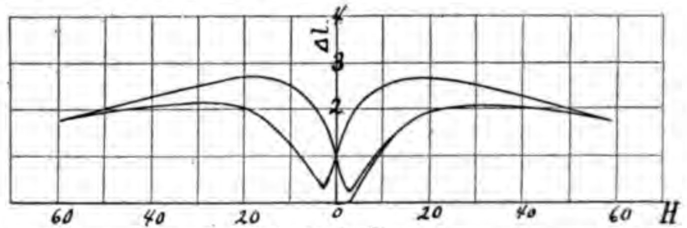


FIG. 1.

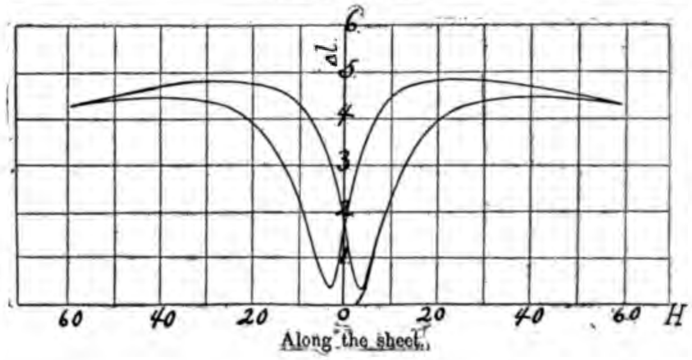
The method consists in hanging a specimen tube coaxially inside a shorter brass tube, to which it is clamped at the lower end. By means of a lever and tilting mirror, changes in their relative lengths may be measured accurately. The magnetic field is excited by a long solenoid, inside which the two tubes hang. The apparatus is a modification of that which has been in use in this laboratory for several years, and was described in *Phil. Mag.*, Vol. 40, p. 345, by Dr. More. (See also *Univ. Circ.*, June, 1897.)

The differences found in the magnetic changes in length, according as the grain runs parallel with, or at right angles to, the length of the specimen, are great, as will be seen in the accompanying curves. The curves in Figure 1 show the changes in length for one specimen of each kind under a cyclic magnetic force between limits of about 60 C. G. S. The curves in Figure 2 show the changes in increasing fields extending up to much higher values. The ordinates are plotted in both cases in millionths of the original length. The abscissae are plotted in C. G. S. units of magnetic field.

The effect of annealing the specimens was to make the maximum length occur in a lower field, and to greatly increase the retentiveness for change of length. The amount of the maximum increase is not affected in specimens cut at right angles to the length of the sheet, but it was greatly diminished in those cut parallel to it.



Across the sheet.



Along the sheet.

FIG. 2.

It is evident from these results that the changes in volume caused by magnetization in a specimen possessing a fibrous structure are dependent upon that structure; and therefore the question is once more opened, whether there would be any such change in an isotropic specimen.

The values of the intensity of magnetization were slightly higher in the same fields for specimens cut parallel to the sheet than for those cut across it.

Determination of Atmospheric Resistance at Speeds of 200 to 500 Miles an Hour. By A. F. Zahm.

There has been some discussion as to the law of atmospheric resistance at speeds between 100 and 1000 feet a second, some writers maintaining that it increases directly as the speed, others that it increases as the square of the speed, while still others hold that it increases as the cube of the speed or according to some more complex relation. These discrepancies are doubtless chargeable to the measuring devices; for, although superb apparatus has been employed for speeds below 100 miles an hour, no method seems ever to have been developed for the direct purpose of measuring resistance at higher speeds. Hence the only data we have for this region are those obtained in the practice of exterior ballistics, which, besides being devoted, for the most part, to speeds above 1000 feet a second, essays, primarily, to determine the *velocity* of projectiles rather than their resistance, a problem which is immensely more difficult.

The resistance is calculated from the rate of change of velocity, or the retardation, and this the ballistic methods have hitherto failed to measure accurately, mainly for the following reasons: (1) the projectiles used in gunnery are too dense; (2) the experiments are usually made outdoors, and hence in more or less wind; (3) the "screens" offer resistance and yield an unknown amount before complete rupture; (4) the chronographs have, until recently, been inaccurate.

The purpose of the research here outlined was to produce a reliable method of measuring the retardation of projectiles and by it to obtain the velocity-resistance curves, for speeds of 50 to 500 miles an hour, of a variety of simple geometrical forms, particularly of the sphere, spheroids, cylinders and other figures of revolution. The work so far accomplished has been to measure the resistance to spheres moving with velocities varying from 300 to 700 feet per second.

A chronograph was designed which offers no resistance to the projectiles, and which, with due care, measures its velocity accurately to less than $\frac{1}{100}$ of one per cent.; hollow projectiles were used which were about 40 times lighter than solid steel ones, thus making the retardation 40 times greater and consequently the resistance measurable with much greater accuracy the experiments were made indoors and in homogeneous still air.

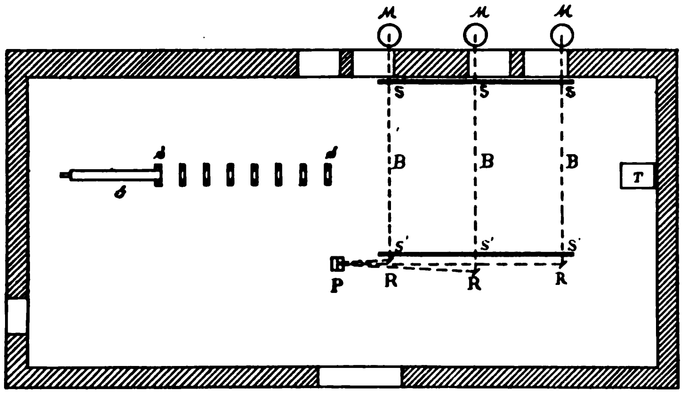


FIG. 1.

The general arrangement of the apparatus is shown in Fig. 1. The ball from the gun, *G*, passes through eight blast-screens, *S–S*, onward through still air, cutting three recording sunbeams, *B, B, B*, and lodges uninjured in a barrel of cotton, *T*. The sunbeams springing from the mirrors *M, M, M*, pass through gauge-slits *s, s, s, s′, s′, s′*, $\frac{1}{100}$ of an inch wide, strike the reflectors *R, R, R*, then pass through a camera lens to focus on a photographic plate, *P*, which falls freely during the bullet's flight. Thus as the ball cuts the sunbeams their tracings on the plate are instantaneously and momentarily interrupted, thereby revealing the bullet's time of transit from beam to beam, whence its velocity and resistance can be computed.

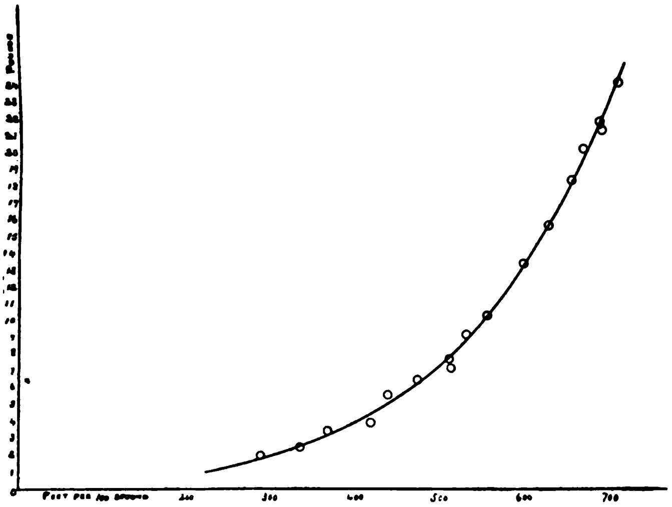


FIG. 2.

The camera is a columnar cast-iron box 5 feet high, 3 by 5 inches inside section, and provided with interior side grooves down which a massive iron bar drops freely, carrying with it a photographic plate 2 feet high by 2½ inches wide, on which are focused the sunbeams through a lens in the side of the box 2 feet from its top. At the bottom of the camera is a cushion which yields to the impact of the falling mass so as not to endanger the plate. After each fall of the plate the camera may be displaced sidewise, say $\frac{3}{16}$ of an inch, while the shutter and lens remain stationary; thus it is possible to take a dozen or more records on one plate. Outside and back of the camera is a trigger whose mechanism drops the plate, opens the shutter and fires the gun at preadjusted time intervals.

The only bullets so far used have been polished four-inch ash spheres, some solid, others hollow of ½ inch wall thickness. The balls are shot by smokeless powder from a 7-foot brass tube of ⅛ inch wall thickness.

The photographic record of each shot is three fine vertical lines, each having a sharp interruption caused by the eclipse of its tracing sunbeam. The distance of each midbreak from the bottom of the photographic line is measured on a dividing engine and the corresponding time of fall of the plate calculated on the assumption that the resistance to descent is negligible. $t = \left(\frac{2h}{g}\right)^{\frac{1}{2}}$. (This assumption is rendered valid by making the plate-holder many hundred times heavier than its resistance to falling.) The distances between the sunbeams are accurately measured, and hence the mean velocity between each eclipse may be calculated. The retardation in 1 sec. is then deduced; and this, multiplied by the mass of the bullet, gives the force of resistance due to the air.

The accompanying table gives the values obtained from the first series of observations, which, as shown in Fig. 2, give a fairly smooth velocity-resistance curve. The quantities are accurate to less than 1 per cent.

VELOCITY AND RESISTANCE OF SPHERE 3″$\frac{63}{64}$ DIAMETER.

VELOCITY. FT. PER SEC.	RESISTANCE. LBS. WG.	VELOCITY. FT. PER SEC.	RESISTANCE. LBS. WG.	VELOCITY. FT. PER SEC.	RESISTANCE. LBS. WG.
438	5.58	555	10.24	286	1.91
688	21.60	512	7.09	333	2.49
473	6.39	628	15.47	367	3.43
417	3.87	691	21.09	599	13.25
510	7.61	656	18.16	691	23.89
531	9.09	670	20.00		

The curve given is considerably steeper than the nearest parabola of the family $R = aV^2$ and much more nearly coincides with one of the family $R = aV^3$, its true form probably being given by a more complex expression. When further records have been taken at higher and lower speeds the equation of the corrected curve may be sought with more profit than that of the present one.

The Concave Grating for Stellar Photography. By CHARLES LANE POOR and S. ALFRED MITCHELL.

The concave grating has proved a most powerful instrument for spectroscopic research, but heretofore it has not been successfully applied to stellar spectroscopy. During the past winter experiments have been carried out with a view of thoroughly testing the various methods of using the concave grating for astronomical purposes. The methods originally suggested by Professor Rowland were developed by Dr. Poor, and the apparatus constructed under his direction; the photographs were made by Mr. Mitchell.

There are two radically different methods for using the concave grating for stellar work:

First, in connection with an objective; the grating merely replacing the ordinary stellar spectroscope. This was tried by Professor Crew at the Lick Observatory in 1892 and a few results obtained.

Second, direct; the grating is the objective and the spectroscope combined: the light from the star being reflected directly from the grating to the photographic plate. This method was first developed by Dr. Poor in 1891, when a few experiments were made. No definite results were then obtained, however. Experiments were resumed in October last, and some promising photographs have since been obtained.

This paper contains a few notes in regard to the second method. The apparatus for mounting the grating is extremely simple, consisting of a light box clamped to the tube of the equatorial, the telescope being used merely as a finder. The light from the star falls directly on the grating, is diffracted and brought to a focus on the photographic plate. The grating is mounted in an ordinary holder, which can be adjusted by side and back screws. The plate holder holds a plate 1 x 5 inches, bent as closely as possible to the proper curve. The holder is capable of adjustment, so that the plate and the grating can be made parallel. The box is clamped to the telescope in such a way that the lines of the grating are parallel to the equator; and accordingly by regulating the driving clock of the telescope to run a little too fast or too slow, the spectrum can be made of any convenient width.

The advantages of this method of working are many. Among them may be mentioned, first, the spectrum is normal; second, great extent of ultra violet, as the light does not pass through any absorbing medium; third, simplicity of mounting and accuracy of following; fourth, ease of determining absolute wave lengths and motion in the line of sight.

Two gratings were experimented with as follows:

A. Two (2) inch concave grating; ruled surface 1 x 2 inches; radius of curvature 1 metre; ruled with 15,000 lines to the inch.

B. Six (6) inch concave grating; ruled surface 2 x 5¾ inches; radius of curvature 1 metre; ruled with 7,419 lines to the inch.

With grating A the photographs were made with the first order spectrum, with the grating B the second order was used. Seed's gilt edge plates and Cramer's isochromatic plates were used. Details of a few specimen plates follow.

With small grating:

Nov. 27, Sirius.—Exposure 40 minutes; width of spectrum, 1.5 mm. Plate shows eight hydrogen and H and K lines.

Jan. 3, Sirius.—Exposure 40 minutes; width of spectrum, 0.1 mm. Plate shows 16 hydrogen, H, K and about 15 other lines.

With large grating:

April 2, Vega.—Exposure 10 minutes; width of spectrum, 0.2 mm. Plate shows fourteen hydrogen and K lines.

April 5, Procyon.—Exposure 38 minutes; width of spectrum, 0.4 mm. Plate shows eleven hydrogen, K and about twenty other fine lines.

April 6, Capella.—Exposure 40 minutes; width of spectrum, 0.4 mm. Plate shows F, G, h, H, K and about 125 lines between F and H.

The Structure of the Shading of the "H and K" and Some Other Lines in the Spectrum of the Sun and Arc. By L. E. Jewell.

Several years ago while examining a series of photographs of the solar spectrum made by Professor Rowland in 1888 and 1889, I discovered one plate on which the shading of the H and K lines (due to calcium vapor) was broken up into bands or series. In each case the bands began at the centre of the shaded lines and extended outward, the distance apart of the component lines of the series increasing as the distance from the centre increased. In each case the series were perfectly symmetrical about the centres of H and K, and the individual lines or components of the series somewhat nebulous, while nearly all other small lines in the same region were sharp, clear lines.

All other plates available were carefully examined without the presence of series being indicated. Possibly a very few of the stronger lines in the series may be present upon most plates, but these lines may be merely approximately coincident and not connected with the series. A great many plates of this region of the spectrum have been taken by myself during the last few years over the centre of the sun, at the sun's limb, over sunspots, and under various conditions; but the presence of these series has never been certainly indicated. It is probable that the principal reason for this is that all the plates taken during several years past have been upon commercial plates which are coarse grained, thus masking the faint lines of the series, while the plate upon which they are shown is almost grainless.

There are several plates taken in the third order spectrum which show the shading of some of the strongest of the iron lines broken up into series; but the component lines are faint, nebulous, and close together. There are also suspicions of the partial resolution of the shading of the strongest lines of some other elements, but it is less certain.

All plates taken of the arc spectrum of the calcium lines H, K and g ($\lambda = 3933.809$, 3968.620 and 4226.892) have been carefully examined without any result until the 11th of last March, when a plate taken under somewhat special conditions showed the shading broken up into series.

I had for a number of years suspected that the shading of lines was produced by the overlapping of many series, all converging towards the principal line, but that under ordinary circumstances it is impossible to separate any series from the others (a possible exception occurs in the shaded lines of tin, which are plainly resolved into series).

It was thought probable that the distance apart of the lines in any particular series depended upon the degree of crowding of the molecules or density of the gas producing the shaded lines, and consequently the damping of the original vibration.

In both the electric arc and the sun's atmosphere we probably have layers of metallic vapors of varying degrees of density, so that the combination will generally produce a smooth shading, gradually increasing in intensity towards the central line.

In the case of the solar spectrum plate under consideration, it was thought that the slit of the spectroscope probably covered a region of the sun's atmosphere where the principal layer of calcium gas was of a particular density, and being thus to a large degree isolated, it was able to produce its characteristic series. This idea is somewhat confirmed by the fact that the general shading of H and K on the plate is unusually weak. These particular conditions would probably be most likely to occur over faculae.

On March 11th, having occasion to photograph the arc spectrum of calcium at λ 4000, I took several plates under widely different conditions. One plate shows the shading of H on the red side quite distinctly broken up into series similar to those of the solar spectrum plate mentioned. The resolution into series on the violet side is less distinct, while the shading of K shows the resolution better upon the violet than upon the red side, though not so distinctly as upon the red side of H.

The resolution into lines is hardly perceptible close to the principal line, but is fairly distinct about three Ångström units from H. In the solar spectrum plate the lines of the series are much more distinct nearer the central line (about 1 or 2 Ångström units away), and become too faint to follow at any great distance. They are much more distinct each side of K than around H.

In the arc spectrum plate it is also to be noted that the lines of the series are reversed, or absorption lines instead of emission lines, although at some distance away from the central lines it is probable that the series are continued as faint emission lines.

The arc spectrum plate showing these series was obtained by using an extremely powerful direct electric current, allowing it to act for a short time before throwing the image of the arc upon the slit of the spectroscope, and then exposing for three or four seconds only. Under these conditions the calcium was rapidly volatilized and the highly heated vapor formed a much more extended atmosphere around the poles than with a weaker current, and it is also possible that the conditions throughout the larger part of the arc were more uniform than under ordinary circumstances.

Announcements of Courses in the Johns Hopkins University for the academic year beginning October 1, 1898, may be had on application to the Registrar of the University.

A detailed statement of the Courses in Physics and in Applied Electricity may also be obtained on application.

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—— On the Photometry of Differently Colored Lights and the Flicker Photometer. (*Physical Review, Vol. III, p.* 241; *Electrical World, Vol. XXVII, p.* 124, 1896).

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Wolff, F. A. On the Influence of Magnetism on Chemical Action.
Dissertation for the Degree of Doctor of Philosophy in the Johns Hopkins University.

Wood, R. W. Apparatus for Illustrating Potential Gradient (*Physical Review, No.* 3, *p.* 164, *March*, 1898);—Apparatus for Showing the Conductivity of Gases (*Ib., No.* 3, *p.* 165, *March*, 1898);—A New Form of Cathode Discharge and the Production of X-Rays, with some Notes on Diffraction (*Ib., Vol. V, p.* 1, *July*, 1897);—Demonstration of the Döppler Effect (*Ib., Vol. IV., p.* 480);—Experimental Determinations of the Temperature in Geissler Tubes (*Ib., Vol. IV, p.* 191);—Lecture Room Demonstration of Orbits of Bodies under the Action of a Central Attraction (*Ib., Vol. IV, p.* 400.)

Wood, R. W. Demonstration of Caustics (*American Journal of Science, Series* 3, *Vol.* 50, *p.* 301.)

—— The X-Ray Arc. (*Electrical Engineer, Vol. XXIII, p.* 444, 1897.)

—— Note on "Focus Tubes" for producing X-Rays (*Philosophical Magazine, 5th Series, Vol.* 41, *p.* 382);—On a Duplex Mercurial Air-Pump (*Ib., 5th Series, Vol.* 41, *p.* 378); —On the Absorption Spectrum of Solutions of Iodine and Bromine above the Critical Temperature (*Ib., 5th Series, Vol.* 41, *p.* 423);—On the Dissociation Degree of some Electrolytes at 0° (*Ib., 5th Series, Vol.* 41, *p.* 117);—On the Duration of the Flash of Exploding Oxyhydrogen (*Ib., 5th Series, Vol.* 41, *p.* 120);—A Simple Method of Determining the Duration of Torsional Oscillations (*Ib., 5th Series, Vol.* 40, *p.* 355.)

Photographic Map of the Normal Solar Spectrum,

MADE BY

Professor H. A. ROWLAND.

This series of photographs of the solar spectrum has been made in the Physical Laboratory of the Johns Hopkins University. Several concave gratings, of 6 inches diameter and 21½ feet radius, having 10,000 or 20 000 lines to the inch, were used for the purpose. The process of making this map is the well known Rowland method, and is based on the property of the concave grating as discovered by Professor Rowland: this property is that the spectrum, as photographed in any given order, is normal and of the same scale throughout. The focus remains automatically adjusted so that one has only to move the instrument to the part of the spectrum required, absorb the overlying spectra and put in the photographic plate. The negatives enlarged have been selected from many hundreds taken from different gratings, though three gratings were finally selected for the work. The negatives from any given order of spectrum are measured from one standard line to another on a dividing engine, so that the constant of the dividing engine is known. The scale is made by ruling on a piece of French plate glass having a coating of blackened collodio-chloride. The negatives are then clamped to the scale firmly, after being adjusted into position by the standards. They are next put in the enlarging apparatus; and the whole is enlarged from 2½ to possibly 4 times, so as to make the scale of the map about 3 times that of Angström's map. The positives thus made are then figured, and negatives are made from them by contact.

The following is a list of the plates:

a from wave length 3000 to 3330
b " " " 3270 to 3730
c " " " 3670 to 4130
d " " " 4050 to 4550
e " " " 4450 to 4950
f from wave length 4850 to 5350
g " " " 5250 to 5750
h " " " 5650 to 6150
i " " " 6050 to 6550
j " " " 6450 to 6950

The plates will be sent by express or mail at the following *net* prices:

Set of ten plates, wave length 3000 to 6950, - - - - -	$20 00
Single plates, - - - - - - - - - - - -	2 50

EXTRA PLATES.

Two plates have been made of the B and D lines. The latter are 3 inches apart, and the former has an extent of about 24 inches. Two enlargements of some of the carbon bands from the arc electric light have also been made. They show the wonderful structure of these bands, each containing many hundred lines, each one of which is a close double or, in some cases, a triple.

Orders should be addressed to

The Johns Hopkins Press, Baltimore, Maryland.

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The Johns Hopkins Press.

LIST OF SERIAL PUBLICATIONS.

I. American Journal of Mathematics.

This journal was commenced in 1878, under the editorial direction of Professor Sylvester. It is now conducted by Professor T. Craig as Editor, with the coöperation of Professor Simon Newcomb. Nineteen volumes of about 400 pages each have been issued, and the twentieth is in progress. It appears quarterly. Subscription $5 per year. Single numbers $1.50.

A very few complete sets remain. These will be sold for one hundred dollars per set.

II. American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as Editor. Nineteen volumes of about 450 pages each have been issued, and the twentieth is in progress. Ten numbers are issued yearly. Subscription $4 per year. Single numbers 50 cents.

III. American Journal of Philology.

The publication of this journal commenced in 1880, under the editorial direction of Professor Gildersleeve. Seventeen volumes of about 570 pages each have been issued, and the eighteenth is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1. Only a few sets remain in the hands of the editor.

IV. Studies from the Biological Laboratory.

The publication of these papers commenced in 1879, under the direction of Professor Martin, with the assistance of Professor W. K. Brooks. Four volumes of about 500 pages, octavo, and 40 plates each, have been issued.

V. Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Professor H. B. Adams. Fifteen series are now completed and the sixteenth series is in progress. Eighteen extra volumes have also been issued. Subscription $3 per volume. A set, including the fifteen regular series and the eighteen extra volumes, will be sold for seventy dollars.

VI. Memoirs from the Biological Laboratory.

These monographs are issued under the editorial direction of Professor W. K. Brooks. Volume IV is in progress. Price for the set of three volumes twenty-five dollars.

VII. Johns Hopkins University Circulars.

The publication of these Circulars began in December, 1879, and 135 numbers have since been issued. Subscription $1.00 per year.

VIII. Contributions to Assyriology and Comparative Semitic Philology.

The publication of these papers was begun in 1889. Professor Paul Haupt, of the Johns Hopkins University, and Professor Friedrich Delitzsch, of the University of Breslau, are the editors. Volume IV is in progress. A set of these papers (three volumes) will be sold for $22.50.

IX. The Johns Hopkins Hospital Reports.

These reports are edited by the Faculty of the Johns Hopkins Medical School and published for the Johns Hopkins Hospital. Their publication was begun in 1890. Volume VII is in progress. Price $5 per volume. The set of seven volumes will be sold for thirty-five dollars.

X. The Johns Hopkins Hospital Bulletin.

The publication of these Bulletins began in 1889. Volume IX is progress. They are published monthly. Subscription $1.00 per year. T set of nine volumes will be sold for fifteen dollars.

XI. Modern Language Notes.

This journal is edited by Professor A. M. Elliott and his associates in t Modern Language Department. It appears monthly. The twelfth volu is in progress. Subscription $1.50 per year.

XII. The Journal of Experimental Medicine.

This journal began publication in 1896. It is edited by Professor W. Welch with the coöperation of a number of associates. It appears six tin yearly. Volume III is in progress. Subscription $5.00 per year. Pr of the set of three volumes twenty dollars.

XIII. American Journal of Insanity.

This journal is edited by Professor Henry M. Hurd and his associ editors. It appears quarterly. Subscription $5.00 per year.

XIV. Annual Report,

Presented by the President to the Board of Trustees, reviewing the ope tions of the University during the past academic year.

XV. Annual Register,

Giving the list of the officers and students and containing detailed sta ments as to the regulations and work of the University.

Announcements of the Graduate, Collegiate and Medical Courses Instruction are issued yearly and will be sent on application.

Among the principal separate publications issued by the Johns Hopki Press are: —

Rowland's Photograph of the Normal Solar Spectrum. T plates. $20. See page 65.

A New Critical Edition of the Hebrew Text of the Old Test ment. Edited by Paul Haupt. Prospectus on application.

The Teaching of the Apostles (complete facsimile edition). Rendel Harris, Editor. 110 pp. and 10 plates. 4to. $5.00.

Reports of the Maryland Geological Survey. Edited by Pr fessor W. B. Clark.

Geological and Topographical Maps of Baltimore and Vici ity. $1.00 each.

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The Genus Salpa. By W. K. Brooks. 396 pp. 4to. 57 plates. $7.5

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Orders should be addressed to the Johns Hopkins Pres Baltimore, Md.

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Published with the approbation of the Board of Trustees

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GENERAL STATEMENTS AS TO THE COURSES OF INSTRUCTION.

he Johns Hopkins University will commence its
ıty-third year of instruction on October 1, 1898.
work will go forward in these divisions:

he Graduate department, in which arrange-
ts are made for the instruction of advanced
ents in the higher studies of literature and
ice;

he Undergraduate or Collegiate department, in
h students receive a liberal education leading
o the degree of Bachelor of Arts;

he Medical department, in which students who
already received a liberal education are re-
ed as candidates for the degree of Doctor of
licine, and in which Doctors of Medicine may
d special courses.

other words, arrangements are made for the
uction of the following classes:

Graduate students and other qualified persons
ring to continue for one or more years their
al education, and possibly to become candi-
s for the degree of Doctor of Philosophy;

Graduate students and other qualified persons
ing to proceed to the degree of Doctor of
licine;

Doctors of Medicine who desire to follow
ial courses of lectures and laboratory work;

Undergraduates looking forward to the degree
achelor of Arts;

Special students who have not received an
lemic degree and are not candidates for a
ee, but who desire to follow special courses of
uction in literature and science.

he medical department is open to women; the
r departments are not.

new academic building, called McCoy Hall, in
memoration of its donor, contains the library and the class-rooms in language, literature, history, and philosophy.

Laboratories are provided in Chemistry, Physics, Electricity, Geology and Mineralogy, and in the Biological Sciences (Anatomy, Physiology, Zoölogy, and Pathology.)

Seminaries are organized in the Greek, Latin, French, German, English, Sanskrit, and Semitic languages, and also in History and Political Science. There are various scientific associations and journal clubs which hold regular meetings.

The Library contains eighty-five thousand volumes, part of which are kept in the central reading room, while the remainder of the books are distributed according to their subjects in the different laboratories and seminaries.

The Library of the Peabody Institute contains one hundred and thirty thousand volumes. These books are selected with reference to the wants of scholars. They are well chosen, well arranged, well bound, and well catalogued, and are accessible daily from nine in the morning until half-past ten in the evening.

The proximity of Baltimore to Washington enables the students to visit the libraries, museums, and scientific foundations of the Capital.

The academic year extends from the first of October to the fifteenth of June.

The charge for tuition is one hundred and fifty dollars per annum in the graduate and undergraduate departments, and two hundred dollars in the medical department.

The Annual Register, giving full statements as to the regulations and work of the University, and separate announcements of the Medical Courses, will be sent on application.

Candidates for admission must have completed the major and minor courses of this University (or their equivalents elsewhere) in physics and mathematics, the minor course in chemistry, and the course in freehand and instrumental drawing; and must be able to read either French or German. Those who have not had all this preparatory training must follow the courses in which they are deficient; only one of these may be taken simultaneously with the regular work of the course.

Persons, not college graduates, who wish to complete their preparation for the work in Applied Electricity, may be admitted to the requisite undergraduate courses, on passing an entrance examination covering the matriculation requirements in the following subjects: mathematics, French or German (first division), English, United States history, and the elements of one of the following branches of science—chemistry, botany, or physical geography. They will then follow for two years the preparatory courses in mathematics, physics, chemistry, and drawing referred to above.

A certificate of proficiency is given to those students who complete the prescribed course in a satisfactory manner, and who possess a knowledge of *both* French and German.

The course may be stated as follows:

First Year.

Applied Electricity.

Three times weekly, through the year. Dr. Duncan.

Lectures and examples on so much of the physical and mathematical theory of electricity and magnetism as is considered useful for application.

Electrical Measurements.

Twice weekly, through the year. Mr. Hering.

Lectures and recitations on the general methods of performing experiments and conducting tests, in which the fundamental measurements in electricity and magnetism and tests of electrical machinery are considered.

Electrical Seminary.

Weekly, through the year. Dr. Duncan, Mr. Hering, and Mr. Geer.

At these meetings the students of both classes review current electrical literature and present carefully prepared papers upon special topics in connection with their studies or their laboratory work.

Mechanics of Engineering.

Twice weekly, through the year. Mr. Geer.

Lectures and problems upon the strength of engineering materials, kinematics of machinery, and machine design, with especial reference to structural strength, arrangement, and utility of electrical machinery.

Mechanical Drawing.

Six hours weekly, through the year. Mr. Geer.

Machine sketches, precise representation, and detail drawing of electrical machinery. Kinematical problems solved graphically and machine parts inserted. Shop drawings of machine details from original designs. Tracing and blue-printing.

Laboratory Work.

Nine hours weekly. Dr. Duncan, Mr. Hering, and Mr. Whitehead.

Exercises are given in fundamental experiments: the measurement of electro-motive force, current, resistance, self and mutual induction, capacity, hysteresis, permeability, etc., tests of batteries, dynamos, motors, incandescent and arc lamps, etc. The work is largely individual, and the character and grade of the work given to the student is determined by his qualifications.

Second Year.

Applied Electricity.

Twice weekly, through the year. Dr. Duncan.

Theory and design of dynamos and motors, transmission of energy, electric traction, telephone and telegraph, alternating apparatus, etc.

Electrical Seminary.

Weekly, through the year. Dr. Duncan, Mr. Hering, and Mr. Geer.

Steam and Hydraulic Engineering.

Three times weekly, through the year. Mr. Geer.

Lectures and examples upon steam engines and other heat motors (Fall term); steam boilers and accessories (Winter term); water power, water motors, and pumps (Spring term).

Central Station Equipment.

Twice weekly, second half-year. Mr. Hering.

Lectures and examples on the design, equipment and testing of electrical power stations, illustrated by personal inspection of large plants in operation and under construction.

Electro-chemistry and Electro-metallurgy.

About twenty lectures, second half-year. Dr. H. C. Jones.

Lectures on the wandering velocities of the ions, conductivity of solutions of electrolytes, calculation of the electromotive force of elements, and the more important methods employed in electro-metallurgy.

Theory of Alternating Current Machinery.

Twice weekly, through the year. Mr. Whitehead.

Lectures and examples on the applications of the theory of alternating currents to the design and construction of apparatus.

Mechanical Drawing.

Six hours weekly, through the year. Mr. Geer.

Design and arrangement of parts, assembly and detail drawings of special problems as assigned during the first part of the year, and of dynamos and Central Stations, etc., prepared largely from the original designs of the students.

Laboratory Work.

Dr. Duncan, Mr. Hering, Mr. Geer, and Mr. Whitehead.

The students are given original problems to work out in the laboratory, and experiments and investigations in alternating currents and transmission plants form an important part of the work. Encouragement will be given for the undertaking of original research.

Some time is devoted to work in steam engineering, including indicator practice, standardizing apparatus, calorimetry, hydraulics, etc.; and engine and boiler trials and tests of the University power plant are made.

CHEMISTRY.

The courses in Chemistry are intended to meet the wants (1) of graduate students who make Chemistry their specialty, or who select it as one of their subordinate subjects for the degree of Doctor of Philosophy; and (2) of undergraduate students who study Chemistry for general training. The first and second years' courses cover the ground of General Chemistry, as far as it is possible to do so in the time occupied. Together they form the full course designed for undergraduates. Graduates, including those who intend to enter the Medical School, who have not done an equivalent amount of work, will follow such parts of these courses as may seem desirable.

Advanced Work for Graduate Students.

Laboratory.

Under the direction of Professors Remsen and Morse. *Daily, except Saturday, from 9 a. m. to 5 p. m.*

The work will consist in a thorough study of analytic methods, in making typical preparations especially of compounds of carbon, and in carrying on investigations.

Lectures.

(*a*) Selected Topics, by Professor REMSEN. *Twice weekly, until Christmas.*

(*b*) Compounds of Carbon, by Professor REMSEN. *Four to five times weekly, from January 1 to the end of the year.*

(*c*) Analytic Methods and Inorganic Chemistry, by Professor MORSE. *Once weekly, through the year.*

(*d*) Physical Chemistry, by Dr. JONES. *Twice weekly, through the year.*

(*e*) Historical Topics, under the direction of the Professor of Chemistry, by advanced students. *About twelve lectures, second half-year.*

This work, while serving to familiarize students with chemical literature, is intended to aid them in acquiring the art of presenting subjects in the form of lectures before audiences. All those who intend to become teachers of Chemistry are expected to take active part in the work.

(*f*) *Journal Meetings.*—The instructors and advanced students will meet weekly, on Saturdays from 9 to 10.30 a. m., and at such other hours as may be appointed, for the purpose of hearing reports on the principal articles contained in the journals of Chemistry.

The reports are furnished in turn by all who attend the meetings. The journals read and regularly reported on are: Annalen der Chemie, Berichte der deutschen chemischen Gesellschaft, Journal of the Chemical Society (London), Journal für praktische Chemie, Zeitschrift für analytische Chemie, Zeitschrift für physikalische Chemie, American Chemical Journal, Journal of the Society of Chemical Industry, Bulletin de la Société chimique, Annales de Chimie et de Physique, Zeitschrift für anorganische Chemie, and occasionally others.

Collegiate Courses.

First Year (Minor) Course.

(*a*) Introduction to General Chemistry.

Lectures and recitations, four hours weekly, through the year, by Professor REMSEN, Professor RENOUF, and Dr. GILPIN.

(*b*) Laboratory Work.

Five to six hours weekly, through the year, under the direction of Professor RENOUF and Dr. GILPIN.

No previous knowledge of chemistry is required. The class-room work is based on Remsen's Chemistry (Briefer Course), and covers the field of inorganic chemistry, as far as possible. The last twenty class-room exercises give a sketch of organic chemistry, particularly for the benefit of those students whose study of chemistry is confined to the minor course. In the laboratory the student repeats the experiments performed in the class-room, and, in addition, has some practice in simple qualitative and quantitative analysis. Each student is required to keep a note-book of his work.

Second Year (Major) Course.

(*a*) Advanced Inorganic Chemistry.

Lectures and recitations, four hours weekly, until Christmas, by Professor RENOUF.

(*b*) Chemistry of the Compounds of Carbon.

Lectures and recitations, four hours weekly, from January 1 to the end of the year, by Professor MORSE.

(*c*) Laboratory Work.

Five to six hours weekly, through the year, under the direction of Professor RENOUF.

The class-room work in inorganic chemistry, in the major course, is confined to a study of the metallic elements and to analytical chemistry. The laboratory work until January is systematic qualitative analysis; from January to the end of the year, the making of inorganic and organic preparations. The compounds to be made are so chosen that the student may become acquainted with as many classes and methods as possible.

GEOLOGY.

The instruction in Geology is under the direction of Dr. WM. BULLOCK CLARK, Professor of Organic Geology, assisted by Dr. HARRY FIELDING REID, Associate Professor of Geological Physics, Dr. EDWARD B. MATHEWS, Associate in Mineralogy and Petrography, Mr. OLIVER L. FASSIG, Instructor in Climatology, and Dr. GEORGE B. SHATTUCK, Instructor in Physiographic Geology. Dr. CHARLES L. POOR, Associate Professor of Astronomy, will give a course upon Exploratory Surveying, in conjunction with Dr. REID, and Mr. GEER, Associate in Mechanical Engineering, will offer a course in map drawing and coloring.

An important course of lectures will be given by Mr. BAILEY WILLIS, of the United States Geological Survey, Lecturer on Stratigraphic and Structural Geology, and a briefer course by Professor CLEVELAND ABBE, of the United States Weather Bureau, Lecturer on Meteorology.

The George Huntington Williams Memorial Lectureship upon the Principles of Geology was inaugurated during the session of 1896–'97 by Sir Archibald Geikie, Director-General of the Geological Surveys of Great Britain and Ireland. It is expected that the second course of lectures will be given during the coming session.

Courses are offered both to graduate and undergraduate students.

In the case of graduate students, the work is arranged to meet the wants (1) of those who desire to make Geology their principal subject for the degree of Doctor of Philosophy, and (2) of those who wish to select certain courses in Geology for one or both of their subordinate subjects, the major subject being taken in another department. Special arrangements may also be made by graduate students whose time is limited, or who desire to devote their attention to particular courses without reference to a degree.

In the case of undergraduate students, Geology may be taken either as one of the major or as one of the minor courses for the degree of Bachelor of Arts.

The courses in Geology consist of lectures, laboratory and field work, and conferences upon topics of current literature. Great importance is attached to laboratory training as a part of the geological course, and facilities are given for daily work from 9 a. m. to 5 p. m.

LECTURE COURSES.

1. General Geology, by Professor Clark and Dr. Shattuck. *Four times weekly.*
2. Paleontology, by Professor Clark. *Twice weekly.*
3. Historical Geology, by Professor Clark. *Twice weekly.*
4. Experimental Geology, by Associate Professor Reid. *Twice weekly, first half-year.*
5. Geological Physics, by Associate Professor Reid. *Twice weekly, second half-year.*
6. Exploratory Surveying, by Associate Professors Poor and Reid. *Twice weekly, for one-third year.*
7. General Mineralogy, by Dr. Mathews. *Four times weekly.*

8. Advanced Mineralogy, by Dr. Mathews. *Three times weekly.*

9. Petrography, by Dr. Mathews. *Three times weekly.*

10. Climatology, by Mr. Fassig. *Twice weekly for one-third year.*

11. Physiographic Geology, by Dr. Shattuck. *Twice weekly for one-third year.*

12. Geological Drawing, by Mr. Geer. *Once weekly.*

13. Stratigraphic and Structural Geology, by Mr. Willis. *Twice weekly for one-third year.*

14. Meteorology, by Professor Abbe.

15. Principles of Geology. (The George Huntington Williams Memorial Lectureship.)

These lectures will be announced later.

LABORATORY WORK.

Laboratory courses are arranged to accompany the lectures, while advanced or special students will be given the opportunity to carry on fuller investigations upon either described or new materials.

CONFERENCES AND STUDENT LECTURES.

In order that the advanced students may be kept in touch with the most recent investigations in the science, conferences are held at which the leading journals in geology are reviewed by the students under the direction of the instructors. The conferences take place bi-weekly.

In order that the advanced students may also have the experience necessary for the successful preparation and delivery of class-room lectures, a course upon some phase of geology is arranged, a special topic being assigned to each student. The lectures take place bi-weekly, alternating with the conferences.

FIELD WORK.

The area of the State of Maryland includes, notwithstanding its comparatively small size, a remarkable sequence of geological formations. The ancient rocks of the earth's crust, as well as those still in the process of deposition, are found, while between these wide limits there is hardly a geological epoch which is not represented. As a result, most excellent facilities are afforded for a study of the various geological horizons.

GEOLOGICAL CAMP.

Arrangements are made annually for a geological encampment of several weeks after the close of the class-room lectures at the University.

GEOLOGICAL LABORATORY AND LIBRARY.

The Geological Laboratory is situated in Hopkins Hall, and comprises over thirty rooms, large and small. Here are placed the library, apparatus and collections, which are accessible to the student daily from 9 a. m. to 5 p. m.

In accordance with the custom of the University, those books relating to the work of the Geological Department are given into its charge, the books of general reference being retained in the University Library.

The general library of the Geological Department contains a good representation of the leading journals and works of reference upon geological subjects. It is greatly enriched by the special Williams, Lewis and Abbe libraries. Extensive series of topographical and geological maps likewise form a portion of the library, and these are constantly increasing in number.

APPARATUS AND COLLECTIONS.

The collections of the Department consist primarily of a large amount of important material brought together from Maryland and adjacent States. It represents all the horizons of the State, being especially rich in crystalline rocks, and in Cretaceous and Tertiary fossils. Some of this material has been already described while much awaits further study.

Among the most important of the special collections are:

The Williams collection of rocks and minerals, the Lewis collection of rocks and thin sections, the Krantz collection of fossils, the Hill collection of rocks and characteristic fossils from the Cretaceous formations of Texas, and the Sturtz, the Lehmann, and the Allen collections.

STATE SCIENTIFIC BUREAUS CONNECTED WITH THE GEOLOGICAL DEPARTMENT.

Two scientific bureaus, established by the Legislature and maintained at the expense of the State, are carried on in connection with the Geological Department. They are the Maryland Geological and Economic Survey, and the Maryland State Weather Service. Professor Clark is in charge of both of these organizations, which are concerned with a study of the geology and physical features of the State of Maryland. A sum of $27,000 annually is appropriated by the State for these bureaus.

BIOLOGY.

The courses in Biology are designed (1) for students who wish to make Zoölogy or Animal Physiology a subject of advanced study and research, or the principal or a subordinate subject for the degree of Doctor of Philosophy; (2) for graduates in medicine who desire a laboratory course in Physiology; (3) for undergraduates who desire some knowledge of the biological sciences as part of a liberal education; and (4) for undergraduates who desire to prepare themselves for the study of medicine.

The biological laboratory will be open daily during the session, except on Saturdays, from 9 a. m. to 5 p. m. The work goes forward under the direction of Professors BROOKS and HOWELL, and Dr. ANDREWS, Dr. DREYER, DR. BARTON, and Dr. JOHNSON.

The marine laboratory is open for part of the year at some place on the sea-shore selected on account of its natural advantages for out-of-door study of animal life, and for the selection of material for original research in zoölogy, comparative anatomy, and embryology.

Graduate Courses.

For advanced students:

1. Professor Brooks will conduct the following courses:

Principles of Zoölogy.
Weekly, from January 1 to April 1.

Principles of Science.
A course of lectures, on the principles of science as illustrated by zoölogy, in October and November.

Advanced lectures in Zoölogy, by instructors and fellows.
Weekly, from January 1 to April 1.

Zoölogical Journal Club.
Weekly, to April 1.

Zoölogical Seminary.
Weekly, from the beginning of the session until April 1.

Marine Zoölogy.
Daily, in June and July.

2. Professor Howell will conduct the following courses:

Animal Physiology.
Four times weekly, throughout the year, with twelve weeks of laboratory work, five hours a week.

This course is designed for the students in the medical school, but it, or an equivalent, will be required of students taking graduate work in animal physiology as a subsidiary subject for the Ph. D. degree.

Physiological Seminary.
Weekly, throughout the year.

Physiological Journal Club.
Weekly, throughout the year, for the discussion of the current journals.

Advanced laboratory work in Physiology (methods of demonstration and research).

Arranged for those who have completed the elementary course in animal physiology. The work is done individually and not in class.

3. Dr. Andrews will conduct a course in Embryology during the winter.

4. Dr. Johnson will conduct the following courses:

The Comparative Morphology of the Vegetable Kingdom.
Twice weekly, throughout the year.

Botanical Seminary.
Twenty meetings during the year.

Herbaria.

Captain John Donnell Smith, of Baltimore, has kindly consented to allow students to avail themselves of the opportunities offered in his private herbarium, which includes some 78,000 sheets of specimens from all parts of the world, and which is especially rich in its representation of the Flora of the United States and of the American tropics. He has also offered to special students the privilege of consulting his extensive botanical library.

Students of Botany have access also to the Schimper collection of European phanerogams, the Fitzgerald collection of mosses, and the local collection of the Baltimore Naturalists' Field Club.

Library Facilities.

The laboratory contains a library supplied with standard biological works and complete sets of the more important journals.

The general library of the University receives all the chief journals of general science, and the transactions of the leading learned societies of the world.

The library of the Peabody Institute, within five minutes' walk of the University, contains complete sets of many of the chief biological journals, of the proceedings of learned societies, and other works of reference.

In the libraries of the Medical and Chirurgical Faculty of Maryland and the Johns Hopkins Hospital a large number of medical periodicals are accessible to members of the University.

Publications.

The University Circulars provide for the prompt publication of abstracts of researches or parts of researches as soon as they are completed and ready for publication, and one number of the Circulars is, each year, devoted to notes from the laboratory.

The Studies from the Biological Laboratory have provided, in the past, for the publication of researches which have not required elaborate illustrations.

From time to time more extensive and elaborate memoirs have been issued by the University Press in a series of illustrated quarto Memoirs.

Collegiate Instruction.

The regular undergraduate instruction in normal biology extends over two years. The first year constitutes a *minor course* and may be taken separately.

Special students, who are not graduates or matriculates, may enter the courses for undergraduates, on giving satisfactory evidence of fitness.

In addition to valuable training of the powers of observation and thought, the courses in Biology present the science of life in its most fundamental aspects, and thus serve as a basis for the study of the phenomena of human existence dealt with in History, Political Economy, Psychology, and Ethics. They are open to all students, no previous training being required; and they will be found useful to those looking forward to a career in the ministry, to those designing to enter the medical profession, and to all who are interested in Natural History. In addition to the regular courses, the excursions of the Naturalists' Field Club, which are open to all, afford opportunities for a less formal study of Nature.

Minor Course.

(Required of all who wish to enter the medical school.)

General Biology.
Five to six hours laboratory work and four lectures and exercises weekly, through the year. Associate Professor ANDREWS, with the aid of Dr. BARTON and laboratory assistants.

In the laboratory, the student studies, with the aid of the microscope and dissections, the life-history and structure of certain animals and plants; the skeletons of man and animals; the development of the frog and the fowl; and the elements of systematic botany. In the lecture room, fundamental facts and laws are emphasized.

Major Course.

This course is designed for those having special interest in some branch of Biology.
Five to six hours laboratory work and four lectures or exercises weekly, through the year.

1. Zoology.
Till January 1. Professor BROOKS.

2. Animal Physiology and Histology.
From January 1 till April 1. Dr. DREYER.

3. Embryology.
From April 1 to the end of the session. Associate Professor ANDREWS.

Elective Course.

Zoology.
Two hours weekly, through the year. Professor BROOKS and Associate Professor ANDREWS.

This is an elementary course to be taken without previous training. It includes excursions, collecting, use of the microscope, and dissection, with a general survey of the groups of animals.

It varies according to the needs of the students.

Elements of Botany.

An introduction to systematic Botany, given by Dr. BARTON in April and May, is open to any student, without previous training, as an equivalent of part of the course in free-hand drawing.

GREEK.

Greek Seminary.

Professor Gildersleeve will conduct the Greek Seminary, the plan of which is based on the continuous study of some leading author or some special department of literature.

The Seminary consists of the director, fellows, and scholars, and such advanced students as shall satisfy the director of their fitness for an active participation in the work by an essay, a critical exercise, or some similar test of attainments and capacity. All graduate students, however, may have the privilege of attending the course.

During the next academic year the study of *Aristophanes and the Old Attic Comedy* will constitute the chief occupation of the members. There will be two meetings a week during the entire session, chiefly for the criticism and interpretation of the author, but auxiliary studies in the literary and political history of the period will also find place in the plan of the Seminary.

Advanced and Graduate Courses.

1. Professor Gildersleeve will also conduct a course of *Practical Exercises in Greek*, consisting chiefly in translation at dictation from Greek into English, and English into Greek, two meetings a week from the beginning of the session to the first of January.

2. He will give a series of *Readings in Aischylos, Sophokles, and Euripides*, once a week after January 1.

3. He will lecture once a week, during the session, on select chapters of *Greek Syntax and Greek Style.*

Arrangements will be made for the competent guidance of the private reading of advanced students; and a course of lectures on *Greek Metres*, with practical exercises, will be conducted by Associate Professor C. W. E. Miller.

The schedule given above is subject to additions and modifications.

The student should be provided with Bergk's or Meineke's complete text, von Velsen's critical edition so far as issued, and Kock's editions of the Knights, Clouds (translated by Humphreys), Birds, and Frogs, and Starkie's Wasps (Macmillan).

It is also desirable that the students should possess some edition of the *Fragmenta Comicorum Graecorum*, if possible Kock's, or, if that should be too expensive (48 marks), Meineke's smaller edition of the fragments, and for the study of the period, Thukydides, Xenophon's Memorabilia and Hellenika, and Plutarch's Lives of Perikles and Alkibiades.

Undergraduate Courses.

For Candidates for Matriculation.

Homer, *Iliad* (book VI); Herodotos (book VII); Sight Reading; Prose Composition.

Three hours weekly, through the year. Associate Professor Miller.

Minor Course.

Xenophon, *Oikonomikos.*

Three hours weekly, first half-year. Associate Professor Spieker.

Private Reading: Plato, *Apology.*

Lysias, *Epitaphios;* Euripides (one play).

Three hours weekly, second half-year. Associate Professor Spieker.

Private Reading: Homer, *Odyssey* (books I, IX, X).

Prose Composition.

Weekly, through the year. Associate Professor Spieker.

Major Course.

Plato, *Protagoras.*

Three hours weekly, first half-year. Associate Professor Spieker.

Private Reading: Aischylos (one play).

Selections from the elegiac, melic, and iambic poets; Sophokles (one play).

Three hours weekly, second half-year. Associate Professor Spieker.

Private Reading: Aristophanes (one play).

Prose Composition.

Weekly, through the year. Associate Professor Spieker.

Elective Course.

Lucian, *Vera Historia;* Letter of James.

Two hours weekly, first half-year. Associate Professor Spieker.

LATIN.

Latin Seminary.

Professor Warren will conduct the Latin Seminary. During the next academic year, the Orations and Letters of Cicero will form the centre of work. There will be two meetings a week during the entire session devoted to interpretation, to various auxiliary studies, and to the presentation of papers prepared by the members of the seminary. Analyses will be given of the more important orations. The letters will be taken up chronologically and in separate groups, and particular attention will be paid to the style of the letters of Cicero's correspondents.

Students are advised to provide themselves in advance with the Teubner edition of Cicero, edited by C. F. W. Müller (Part II, vols. 1, 2, and 3, contain the Orations, Part III, vols. 1 and 2, the Letters); and (for course 2 mentioned below) with F. Marx, Incerti Auctoris de ratione dicendi ad C. Herennium Libri IV (Teubner).

Advanced and Graduate Courses.

1. During the first half-year, Professor Warren will give a course of weekly lectures on subjects intimately connected with the work of the Seminary, such as the rise and decline of Roman Oratory, and the study of Rhetoric among the Romans.

2. During the first half-year, Professor Warren will also read with a class once a week the rhetorical treatise entitled ad C. Herennium libri IV.

3. Throughout the year he will lecture once a week on the Roman Forum and the Imperial Fora.

4. A Journal Club will meet regularly to report on current philological periodicals containing articles of interest to Latinists.

5. Associate Professor Kirby F. Smith will conduct throughout the year a course of practical exercises in Latin, consisting chiefly in translation at dictation from Latin into English and from English into Latin.

6. The subject of the Pro-Seminary to be conducted by Associate Professor Smith will be determined later.

7. A reading class will meet regularly once a week throughout the year, for rapid reading of Cicero in connection with the seminary work.

8. During the second half-year Dr. H. L. Wilson will give a course in the Silvae of Statius once a week.

The schedule above given is subject to additions and modifications.

Undergraduate Courses.

For Candidates for Matriculation.

(selected Letters); Sallust, *Catiline.*
hours weekly, first half-year. Dr. Wilson.

Heroides; Vergil, *Georgics* (selections).
hours weekly, second half-year. Dr. Wilson.

Composition.
ly, through the year. Dr. Wilson.

Minor Course.

(two books).
e hours weekly, first half-year. Dr. Wilson.

te Reading: Caesar, *Bellum Civile* (book i); Suetonius,
ugustus.

e (selections).
e hours weekly, second half-year. Dr. Wilson.

te Reading: Horace, *Ars Poetica;* Vergil, *Aeneid* (books
x, xii).

ry of Roman Literature (with reading of selected passages).
ly, through the year. Associate Professor Smith.
or students in Group VI, as a substitute for Prose Composition.]

Composition.
ly, through the year. Dr. Wilson.

Major Course.

al; Pliny.
e hours weekly, first half-year. Associate Professor Smith.

te Reading: Quintilian (book x); Lucan (book vii).

ce (one play); Plautus (one play).
e hours weekly, second half-year. Associate Professor Smith.

te Reading: Plautus, *Miles Gloriosus.*

Composition.
ly, through the year. Associate Professor Smith.

Elective Course.

ions from Tacitus.
hours weekly, second half-year. Associate Professor Smith.

course is designed primarily for students of the third year, whose
edge of the language is somewhat advanced. It is proposed to read
y selections from the Annals and Histories of Tacitus.

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undergraduate courses in Latin vary somewhat according to the
of studies chosen, and the works which are read differ year by year,
is intended that every student shall gain as wide a knowledge of the
ure, and as intelligent an appreciation of those authors most typical
great representative departments and periods of Roman life and
ht, as is possible within the time at his command.

authors prescribed for private reading are chosen either as supple-
ng the work of the class-room, or as leading the student into paths
otherwise he would be obliged to leave unexplored.

importance of Latin prose composition is insisted upon as the best
ost efficient method of acquiring that knowledge of the underlying
ples of the language, without which an intelligent appreciation of the
ure is impossible.

ORIENTAL SEMINARY.

Biblical Philology.

ritical Interpretation of Selected Chapters of the Authorized
rsion.
fessor Haupt. *Tuesday, 5 p. m.*

2. Historical Geography of Palestine.
Dr. Johnston. *Friday, 10 a. m., during the second half-year.*

3. History of Egypt.
Dr. Johnston. *Friday, 10 a. m., during the first half-year.*

4. Elementary Hebrew.
Professor Haupt. *Wednesday, 3–5 p. m.*

5. Hebrew (Second Year's Course): Interpretation of the Book of Genesis.
Professor Haupt. *Monday, 5 p. m.*

6. Exercises in Reading Hebrew at Sight.
Dr. Johnston. *Weekly, through the year.*

7. Hebrew Prose Composition.
Professor Haupt. *Tuesday, 3.30 p. m.*

8. Comparative Semitic Grammar.
Professor Haupt. *Monday, 3 p. m.*

9. Hebrew (Advanced Course): Critical Interpretation of the Book of Job.
Professor Haupt. *Monday, 4 p. m.*

10. Post-Biblical Hebrew (Selections from the Mishnah and the Talmud).
Mr. Rosenau. *Weekly, through the year.*

11. Biblical Aramaic: Interpretation of the Aramaic portions of the Book of Ezra.
Professor Haupt. *Wednesday, 5 p. m., during the first half-year.*

Syriac and Ethiopic.

12. Syriac (Roediger's Chrestomathy).
Dr. Johnston. *Weekly, through the year.*

13. Ethiopic.
Professor Haupt. *Tuesday, 4 p. m., during the second half-year.*

Arabic.

14. Arabic for Beginners.
Dr. Johnston. *Weekly, through the year.*

15. Selected Suras of the Koran.
Dr. Johnston. *Weekly, through the year.*

16. Arabic Prose Composition.
Professor Haupt. *Tuesday, 3–3.30 p. m.*

Assyriology.

17. Assyrian for Beginners.
Dr. Johnston. *Two hours weekly, through the year.*

18. Epistolary Literature of the Assyrians and Babylonians.
Dr. Johnston. *Weekly, through the year.*

19. Sumerian: Selected Bilingual Hymns and Incantations.
Professor Haupt. *Tuesday, 4 p. m., during the first half-year.*

SANSKRIT AND COMPARATIVE PHILOLOGY.

The following courses, in charge of Professor Bloomfield, may be stated under two heads:

A. Indo-Iranian Languages.

1. Vedic Seminary: Hymns of the Rig-Veda, in the light of general Vedic criticism.
Weekly (1½ hours), through the year.

Under the methods of Vedic study pursued in this Seminary absolute restriction to any single Vedic document is precluded. The Vedas are studied as a unit: no conception or expression of a single text is regarded as satisfactorily understood, until it is tested in the light of the related conceptions in other parts of the Vedic literature. The hymns selected will bear upon the most representative mythological and religious ideas of the earliest Vedic writings.

2. The language and literature of the Avesta, the Zoroastrian bible: advanced course.

Weekly, through the year.

3. The drama Çakuntala, with an introduction to the Prākrit dialect of the dramas.

Weekly, through the year.

4. Selections from the Hitopadeça, and the law-book of Manu (second year's course in classical Sanskrit).

Weekly, first half-year.

5. The elements of Vedic Philology: Vedic grammar and selected easy hymns.

Weekly, second half-year.

6. Beginner's course in Sanskrit: grammar and interpretation of an easy text.

Twice weekly, through the year.

B. Linguistic Science and Comparative Grammar of the Indo-European Languages.

7. The Elements of Linguistic Science, with an introductory account of the Ethnology of the Indo-European peoples.

Weekly, through the year.

8. The elements of Phonetics.

Weekly, first half-year.

9. Comparative Grammar of Greek, Latin, German, and Sanskrit. The history of the vowels, and their *ablaut*-relations.

Weekly, through the year.

10. The Lithuanian Language and Literature: advanced course.

Weekly, through the year.

No knowledge of Sanskrit is required for any of the courses under B. Course 7 sketches briefly the history of the science of language; presents a concise account of the ethnological history of the Indo-European (Aryan) peoples; deals with the fundamental questions of growth and change in language; and finally treats of the origin of language. Course 8, offered for the first time in this department, will be carried on in practical conferences, for the purpose of familiarizing students of language and philology in general with the nature of spoken sounds. Course 9 is intended as an introduction into the most elementary methods and results of the comparative grammar of the more important Indo-European languages.

ENGLISH.

A.

Professor Bright will conduct the following courses:

I.

English Seminary.

Graduate students are admitted to the Seminary as soon as they have satisfied initial requirements for independent research. The discipline of the Seminary is designed to impart training in scholarly methods of dealing with literary and linguistic problems. Study and investigation are bestowed upon selected periods of literary history, upon departments of literature extending through successive periods, and upon the works of important writers, separately or in groups. Usually there is a change of subject each half-year.

The following subjects are announced for the academic year beginning October 1, 1898: (*a*) English Dramatic Literature before Shakespeare (*first half-year*); (*b*) The Prose Literature of the Anglo-Saxon Period (*second half-year*).

The meetings of the Seminary will occupy four hours a week. *Tuesday and Thursday, 3–5 p. m.*

II.

Lectures on the History of the English Language. *Tuesday, 12 m. and Wednesday, 4 p. m., first half-year; Wednesday, 4 p. m., second half-year.*

III.

The Interpretation of Texts: (*a*) The Poems of Shakespeare. *Thursday, 12 m., first half-year;* (*b*) The *Ormulum*, *King Horn*, and *Havelok the Dane*. *Tuesday and Thursday, 12 m., second half-year.*

IV.

The English Journal Club (*fortnightly, two hours*), for reports on the current journals, reviews of new books, and the presentation and discussion of original papers on linguistic and literary subjects.

V.

An introductory course in Anglo-Saxon, with Bright's Anglo-Saxon Reader as the text-book. *Monday and Wednesday, 12 m.*

B.

Professor Browne will give the following courses in English Literature:

VI.

A general course covering the whole field, from the 7th to the 19th century. The study, of course, is synoptical; but emphasis is laid upon the chief writers and most important periods. Morley's *Manual* (Tyler's edition) is used as a text-book. *Wednesday and Thursday, 1 p. m.*

VII.

A course in the writers of the 12th, 13th, and 14th centuries (from the Peterborough Chronicle to Chaucer). The texts are read from Morris and Skeat's *Specimens*, the students beginning with the easier and proceeding to the more difficult. In addition to the knowledge thus acquired of an interesting and formative period of our literature, this introduction to the early forms of the language will be found a helpful prodromus to the study of Anglo-Saxon. *Monday and Tuesday, 1 p. m.*

VIII.

A course in the writers of the Elizabethan period. The origin and development of the English drama will be traced from its earliest recorded beginnings down to Shakespeare, the representative of its highest perfection, and in its decadence in the later Jacobean dramatists. *Tuesday, 12 m., first half-year.*

IX.

A course in the literature of the 14th century, with special reference to Chaucer and Langland. *Tuesday, 12 m., second half-year.*

X.

The Early Scottish Poetry from Barbour (A. D. 1350) to Lyndsay (A. D. 1550) will be studied by the aid of a chrestomathy especially prepared for this class. A course of historical and critical lectures will be given concurrently with the readings. *Friday, 12 m.*

XI.

Lectures, for advanced students, on the Art of Criticism, and on some significant period of English Literature. *Wednesday, 11 a. m.*

C.

Professor **GREENE** will give the following courses in Rhetoric and English Literature:

XII.

Rhetoric and English Composition. Theory, based upon text-books, lectures, and discussions; critical study of prose writers; frequent practice in writing. *Monday, Tuesday, and Wednesday, 12 m.*

XIII.

English Literature. Outline history, with special study of the more important writers. *Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m.*

XIV.

Special study of the literature of the eighteenth and nineteenth centuries. *Twice weekly.*

NOTE.—Courses I–IV, XI, are for graduate students.

Courses VI and VII constitute the "English Minor," and V, VIII, IX, and X, the "English Major," of Group VII.

Course XII is prescribed for all college students during their first year; XIII is prescribed for the second year; and XIV is elective in the third year.

GERMAN.

German Seminary.

The German Seminary will be conducted by Professor **WOOD**. The subject for the first half-year will be 'Storm and Stress' and Early Romanticism. These two themes will be studied as parts of one continuous development in German literature. Goethe, Lenz, Klinger, Tieck, and the Schlegels will receive particular attention. During the second half-year, the Middle High German Lyric will be studied in the poems of Walther von der Vogelweide. The Seminary will meet three times weekly, through the year.

Students are requested to procure *Stürmer und Dränger*, Deutsche Nationalliteratur, hrsg. J. Kürschner, Bände 79–81, Stuttgart; Wilmanns, *Gedichte Walthers von der Vogelweide*, 2. Ausgabe (Germanistische Handbibliothek I), Halle, 1883; Lachmann, *Gedichte Walthers*, 5. Ausgabe, Berlin, 1875; Wilmanns, *Leben und Dichten Walthers*, Bonn, 1882; Burdach, *Reinmar der Alte und Walther von der Vogelweide*, Leipzig, 1880.

The Germanic Society, which is composed of the Director of the Seminary, the Instructors, and the Graduate Students in German, will meet fortnightly in an evening session. The members report upon the contents of current journals, and present, in turn, papers upon subjects connected with the work of the year, or assigned for investigation.

Graduate Courses.

Professor **WOOD** will conduct the following courses:

1. Gothic and the Elements of Comparative German Grammar. *Twice weekly, through the year.*

Braune, *Gotische Grammatik*, 4. Auflage, Halle, 1895; Kluge, *Vorgeschichte der altgermanischen Dialekte* (Sonderabdruck aus der 2. Auflage von Paul's Grundriss der germanischen Philologie), Strassburg, 1897; Heyne's *Ulfilas*, 9. Auflage, von F. Wrede, Paderborn, 1896.

2. Old Norse. *Weekly, first half-year; twice weekly, second half-year.*

Holthausen, *Altisländisches Elementarbuch*, Weimar, 1895 (*Lesebuch*, Weimar, 1896); Noreen, *Altisländische Grammatik*, 2. Auflage, Halle, 1892; Noreen, *Abriss der urgermanischen Lautlehre*, Strassburg, 1894.

3. Old High German. Otfrid. *Weekly, through the year.*

Erdmann, *Otfrids Evangelienbuch*, Halle, 1882; Kelle, *Geschichte der deutschen Litteratur*, Band I., Berlin, 1892.

Dr. B. J. Vos, Associate Professor of German, will give the following courses:

4. Middle High German. *Twice weekly, first half-year.*

Paul, *Mittelhochdeutsche Grammatik*, 4. Auflage, Halle, 1894; *Helmbrecht*, ed. Keinz, 2. Auflage, Leipzig, 1887; Lexer, *Mittelhochdeutsches Taschen-Wörterbuch.*

5. Middle Dutch. *Twice weekly, first half-year.*

Franck, *Mittelniederländische Grammatik mit Lesestücken und Glossar;* te Winkel, *Geschichte der niederländischen Sprache und Literatur* (Paul's *Grundriss I and II*).

6. History of Rime in Old and Middle High German. Lectures. *Weekly, second half-year.*

W. Grimm, *Zur Geschichte des Reims*, Berlin, 1852.

7. Vondel as Lyric Poet. *Weekly, second half-year.*

Vondel, ed. *van Lennep-Unger*, Leiden, 1888–91; Jonckbloet, *Geschiedenis der Nederlandsche Letterkunde in de zeventiende eeuw*, vierde druk; twee deelen, Groningen, 1887–91; G. Kalff, *Vondels Leven*, Haarlem, 1896; van Helten, *Vondel's Taal*, Groningen, 1883.

Dr. T. S. **BAKER** will give the following courses:

8. Opitz, and the New Poetry of the 17th Century. *Weekly, through the year.*

Ausgewählte Dichtungen von Martin Opitz, hrsg. von J. Tittmann, Leipzig, 1869; *Gedichte von G. R. Weckherlin*, hrsg. von K. Goedeke, Leipzig, 1875.

9. Contemporary German Drama. *Weekly, through the year.*

Wildenbruch, Sudermann, Hauptmann, die freie Bühne. Scandinavian and French influence.

Undergraduate Courses.

For Candidates for Matriculation.

Elementary German:

Thomas, *Practical German Grammar;* Meissner, *German Conversation;* Super, *Elementary German Reader;* E. S. Buchheim, *Short German Plays.*

Three hours weekly, through the year. Dr. Vos.

This course is intended for students who offer Greek for matriculation. Those who follow it are required to take Minor A in their groups.

Minor Course.

Class A:

Classics: Schiller, *Maria Stuart;* Goethe, *Hermann und Dorothea.*

Two hours weekly, through the year. Dr. Vos.

Prose Readings: Chamisso, *Peter Schlemihl;* von Wildenbruch, *Das edle Blut.*

Weekly, through the year. Dr. Vos.

Prose Composition.

Weekly, through the year. Professor WOOD.

Private Reading: Freytag, *Doktor Luther.*

Class B:

Otis, *Elementary German;* Brandt, *German Reader;* von Moser, *Der Bibliothekar;* Goethe, *Egmont;* Prose Composition (E.

S. Buchheim, *Elementary German Prose Composition*, Oxford, 1893); Whitney, *German Grammar.*

Four hours weekly, through the year. Dr. Baker.

Minor Course B is intended only for students who have matriculated in Greek, and have fully met *at entrance* the matriculation requirements; for such students, it absolves the requirements in German. Other students must absolve Minor A.

Major Course.

Drama.

Goethe, *Faust.* Professor Wood. Schiller, *Wallensteins Lager, Die Piccolomini.* Dr. Vos.

Two hours weekly, through the year.

History of German Literature.

Weekly, through the year. Professor Wood and Dr. Vos.

Prose Composition.

C. A. Buchheim, *Materials for German Prose Composition*, Parts I and II, London, 1894.

Weekly, through the year.

Private Reading: Schiller, *Wallensteins Tod.*

Note.—Beginning with the session 1898–99, all class exercises in the German Major Course will be held at 11 a. m.

Elective Courses.

Contemporary Literature, in Rapid Readings.

Works by Hauptmann, Sudermann, Ebner-Eschenbach, and von Wildenbruch are read.

Two hours weekly, through the year. Dr. Baker.

This course is intended for students who have completed the equivalent of a Minor.

Readings in Natural Science.

Brandt and Day, *German Scientific Reading;* Cohn, *Über Bakterien, die kleinsten lebenden Wesen.*

Two hours weekly, through the year. Dr. Baker.

Special Courses.

Scientific German.

Dippold, *Scientific German Reader;* von Helmholtz, *Über Goethe's naturwissenschaftliche Arbeiten.*

Twice weekly. Dr. Hofmann.

This course is open to graduate students who already possess an elementary knowledge of German, and wish to acquire greater fluency in reading. Successful completion of the course is accepted as an equivalent of the reading knowledge of German required of candidates for the degree of Doctor of Philosophy.

Oral Exercises in German.

Weekly. Dr. Hofmann.

This course is intended especially for students in the departments of modern languages, who lack an extended vocabulary and sufficient familiarity with written and spoken German. A thorough knowledge of the elements is presupposed.

ROMANCE LANGUAGES.

Advanced Courses.

I. With second and third year students:

Professor Elliott.

(*a*). Seminary. *Twice weekly.*

The Fables of Marie de France; Work on Manuscripts.

(*b*). French Dialects. *Weekly.*

(*c*). Lectures on Dante. *Weekly.*

(*d*). Romance Club. *Weekly.*

Professor F. M. Warren.

(*e*). The Epic of Antiquity. *Twenty lectures in the month of February.*

(*f*). Realism and Naturalism. *Eight public lectures.*

[I. Beginnings of Realism in antecedent literature; II. Stendhal. Mérimée; III–IV. Balzac; V. Naturalism. Flaubert; VI. The De Goncourts. Baudelaire; VII. Daudet. Dumas *Fils;* VIII. Zola.]

Dr. Marden.

(*g*). Spanish Philology. *Twice weekly.*

Gorra, *Lingua e Letteratura Spagnuola delle Origini;* Baist, *Die Spanische Sprache* (in Gröber's *Grundriss der Romanischen Philologie*); Meyer-Lübke, *Grammaire des Langues Romanes*, vols. I, II.

(*h*). Old Spanish Readings. *Weekly.*

Gorra, *Lingua e Litteratura Spagnuola delle Origini;* Lidforss, *Los Cantares de Myo Cid;* Janer, *Poetas Castellanos anteriores al Siglo XV.*

(*i*). Lectures on the beginnings of Spanish literature. *Weekly.*

II. With first year students:

Professor Elliott.

(*a*). Popular Latin. *Weekly.*

Associate Professor Rambeau.

(*b*). Phonetics and French pronunciation, with practical exercises. *Weekly, second half-year.*

A. Rambeau and Jean Passy, *Chrestomathie française*, Holt, New York, 1897; Paul Passy, *Les sons du français*, 4th edition, 1895.

Dr. Armstrong.

(*c*). Old French Phonology and Morphology. *Three hours weekly.*

Schwan-Behrens, *Grammatik des Altfranzösichen;* Suchier, *Le Français et le Provençal;* Suchier, *Altfranzösiche Grammatik;* Körting, *Lateinisch-romanisches Wörterbuch.*

(*d*). French Physiological Phonetics. *Weekly.*

Passy, *Les sons du français;* Beyer, *Französiche Phonetik;* Sweet, *Primer of Phonetics;* Vietor, *Elemente der Phonetik;* Michaelis and Passy, *Dictionnaire Phonétique de la Langue Française.*

(*e*). Italian Philology. *Twice weekly.*

Meyer-Lübke, *Italienische Grammatik;* Meyer-Lübke, *Grammaire des Langues Romanes;* Caix, *Origini della Lingua Poetica Italiana.*

Dr. Keidel.

(*f*). Methodology of the Romance Languages. *Weekly, first half-year.*

(*g*). Paleography. *Weekly, second half-year.*

Dr. Ogden.

(*h*). The development of the French novel in the nineteenth century. *Weekly.*

Dr. R. H. Wilson.

(*i*). Historical French Syntax. *Twice weekly.*

(*j*). Old French Readings. *Twice weekly.*

Bartsch and Horning, *La Langue et la Littérature Françaises;* Paris, *Extraits de la Chanson de Roland;* Koschwitz, *Pèlerinage de Charlemagne;* Suchier, *Aucassin et Nicolete;* Warnke, *Die Lais der Marie de France;* Hofmann, *Amis et Amiles.*

Undergraduate Courses.

Associate Professor Rambeau.

French: *Second Year (Major) Course.*

tline of the History of French Literature from the beginnings to the XIXth century, especially the XVIIth century; study of Classical Tragedy and Comedy.

id reading of Corneille, Racine, and especially Molière. *Twice weekly.*

terature of the XIXth century, especially the Romantic Movement.

or Hugo, *Les Travailleurs de la mer*, *Notre-Dame de Paris*, *Ruy Blas*; odern Lyrics: Béranger, Lamartine, Victor Hugo, Alfred de Musset, e *Parnassiens*. *Weekly.*

ate reading to be announced later.

ose Composition.

y of idioms and original essays with reference to subjects and authors ad in the class. *Weekly.*

nch: *First Year (Minor) Course: Class A.*

ort outline of the History of French Literature (XVII–XIX centuries), and reading of Contes, Novels, and Dramas.

ée, *Contes* (*on rend l'argent*, etc.); Mérimée, *Colomba*; Molière, *Le urgeois gentilhomme*; Hugo, *Hernani*; Béranger, *Chansons*. *Twice ekly.*

odern French Comedy.

be and Legouvé, *Bataille de dames*; Augier, *La Pierre de touche*; illeron, *Le Monde où l'on s'ennuie*. *Weekly.*

ate reading to be announced later.

ose Composition and Syntax.

er's Grammar with Exercises by Logie, and Exercises based on *lomba*, ed. Kimball. *Weekly.*

GDEN.

nch: *First Year (Minor) Course: Class B.*

tney's *Brief French Grammar*; Exercises in Grammar and Composion; Exercises in Prose Composition based on texts used; Super's *ench Reader*; Dumas, *L'Évasion du Duc de Beaufort*; Mérimée, *lomba*; Augier, *Le Gendre de M. Poirier*.

undergraduates who have matriculated in Greek, and for graduates ginning French. *Four hours weekly.*

RMSTRONG.

nch: *Elementary Course.*

tney's *Brief French Grammar*; Super's *French Reader*; Jules Verne, *Expédition de la Jeune-Hardie*; Alfred de Musset, *Pierre et Camille*.

candidates for matriculation who offer Greek. *Three hours weekly.*

EIDEL.

nch: *Elective Course.*

, *Pêcheurs d'Islande*; Theuriet, *Le Mariage de Gérard*; selected stories Coppée, Daudet, Theuriet, and others.

students who have completed the equivalent of a Minor. *Twice ekly.*

iate Professor RAMBEAU.

lian: *Minor Course. Four hours weekly.*

dgent's Italian Grammar and Composition.

aciari, *Sintassi italiana*; Fornaciari, *Disegno storico della letteratura liana*; Guarnerio, *Manuale di versificazione italiana*.

zoni, *I Promessi Sposi*; De Amicis, *Cuore*, ed. Kuhns, and other vels; Verga, *Vita dei campi*; Serao, *All'erta, sentinella!*; Floscolo, *riche scelte* (ed. Ferrari); a comedy of Goldoni; a tragedy of Alfieri; lections from Tasso's *Gerusalemme liberata* and Dante's *Divina Comdia*.

ILSON.

lian: *Elective Course. Twice weekly.*

Testa, *L'Oro e l'Orpello*; De Amicis, *Alberto*, *Camilla*; Farina, *Fra Corde d'un Contrabbasso*; Barrili, *La Donna di Picche*; Verga, *Cavalia Rusticana*; Capuana, *Homo*.

ARDEN.

nish: *Minor Course. Four hours weekly.*

ning's *Spanish Grammar*; Matzke's *First Spanish Readings*; Caballero, *Familia de Alvareda*; Alarcon, *El Sombrero de Tres Picos*; Bretón, *Independencia*.

Spanish: *Elective Course. Twice weekly.*

Manning's *Spanish Grammar*; Matzke's *First Spanish Readings*; Palacio Valdés, *José*.

HISTORY, POLITICS, AND ECONOMICS.

HISTORY.

Professor HERBERT B. ADAMS:

1. Historical Seminary.
   Alternate Friday evenings. For graduates only.
2. Germanic History.
   Two hours weekly, first half-year. For graduates.
3. Early English History.
   Two hours weekly, second half-year. For graduates.
4. History of the Nineteenth Century.
   One hour weekly, first half-year. For graduates.
5. History of Education.
   One hour weekly, second half-year. For graduates.
6. History of Civilization.
   Two hours weekly, through the year. Designed for undergraduates, open to graduates.

Associate Professor J. M. VINCENT:

1. Social and Economic History of the Middle Ages.
   Two hours weekly, first half-year. For graduates.
2. Early Modern History of Europe.
   Two hours weekly, second half-year. For graduates.
3. Historical Conference. Practical exercises in historical research.
   Two hours fortnightly, through the year. For graduates.
4. European History from 800 A. D. (Major Course).
   Two hours weekly, through the year.
5. Historical Politics (History-Economic Course).
   Two hours weekly, through the year. Required of all undergraduates.

Dr. BERNARD C. STEINER, Associate in History:

American Political and Constitutional History.
Two hours weekly, through the year. For undergraduates.

Dr. J. C. BALLAGH, Associate in History:

1. Classical and Early European History.
   Four hours weekly, through the year. For undergraduates.
2. American Economic History.
   One hour weekly, through the year. For graduates only.
3. Southern History.
   One hour weekly, through the year. For graduates.
4. Local and Municipal Government.
   One hour weekly, through the year. For graduates.
5. Oral Examinations in History.
   One hour weekly, through the year. For graduates.

Dr. JAMES SCHOULER:

American Political History.
Twelve lectures, in January and February, 1899.

Dr. JOHN H. LATANÉ:

American Diplomatic History.
Twenty-five lectures. For graduates only.

Dr. GUY CARLETON LEE, Instructor in History:

1. English Political and Constitutional History.
   Two hours weekly, through the year. For undergraduates.

2. Parliamentary Law and Procedure.
Two hours weekly, through the year. For undergraduates.

3. Public Speaking and Class Debates.
Six hours weekly, through the year. For undergraduates.

ECONOMICS.

Associate Professor SIDNEY SHERWOOD:

1. Economic Conference and Journal Club.
Two hours weekly, through the year. For graduates.

2. Corporations.
Two hours weekly, first half-year. For graduates.

3. Money.
Two hours weekly, second half-year. For graduates.

4. Legal Aspects of Economics.
One hour weekly, through the year. For graduates.

5. Elements of Economics.
Two hours weekly, first half-year. Required of all undergraduates.

6. Recent Economic Theories.
Two hours weekly, second half-year. Designed for undergraduates, open to graduates.

Dr. J. H. HOLLANDER, Associate in Economics:

1. Development of Economic Theories since Adam Smith.
Two hours weekly, first half-year. For graduates.

2. History and Theory of Industrial Crises.
Two hours weekly, second half-year. For graduates.

3. Recent Economic Changes.
Two hours weekly, first half-year. For graduates and undergraduates.

4. History of Economic Thought.
Two hours weekly, first half-year. For undergraduates in Group VI.

5. International Trade and Socialism.
Two hours weekly, second half-year. For undergraduates in Group VI.

6. Money and Taxation.
Two hours weekly, second halfyear. Required of all undergraduates.

Dr. H. L. MOORE, Professor of Economics, Smith College:
Trusts.
Twelve lectures in January. For graduates only.

POLITICS.

Dr. W. W. WILLOUGHBY, Associate in Political Science:

1. History of Modern Political Philosophy.
Two hours weekly, first half-year. For graduates only.

2. Labor Legislation and its Judicial Interpretation.
Two hours weekly, second half-year. For graduates.

3. American Constitutional Law.
Two hours weekly, through the year. For graduates.

4. Political Conference.
Two hours fortnightly, through the year. For graduates.

PHILOSOPHY.

The undergraduate courses in Philosophy provide five hours per week of work for one year, under the direction of Professor GRIFFIN. All candidates for the degree of Bachelor of Arts are required to follow them during the last year of residence.

1. Deductive and Inductive Logic.

Attention is given to the general theories of Deduction and Induction; to the forms of thought—notion, judgment, and reasoning; to the application of the rules of the syllogism and the detection of fallacies; and to the methods of scientific investigation and proof.

Jevons's Elementary Lessons in Logic and Fowler's Elements of Inductive Logic are used as text-books, with references to the works of Mill, Bain, Keynes, and other writers.
Four hours weekly, until Christmas.

2. Psychology.

The instruction in psychology is intended to give a general view of the results of the present methods of study, the investigations in regard to the quality and intensity of sensations, the duration of psychic acts, etc.,—in general, the subjects treated in Part II of Ladd's Physiological Psychology—being presented with sufficient detail to render them intelligible and interesting. A series of lectures and demonstrations on the anatomy and physiology of the nervous system—given in 1897–98 by Dr. L. F. Barker—is included in the course.

Especial emphasis is laid upon the facts of conscious experience as known through introspection, the most important end to be secured being, it is believed, such an understanding of the facts and laws of mental life as shall fit one for wise self-government and effective influence. With this view, such powers and states of mind as attention, memory, association, habit, imagination, the feelings, the will, are discussed in as concrete and practical a way as possible. A text-book is used as a basis of instruction, but this is largely supplemented by informal lectures, and by references to various authorities.

Baldwin's Elements of Psychology, Sully's Human Mind, James's Psychology, Höffding's Outlines of Psychology, Dewey's Psychology, Hamilton's Lectures on Metaphysics, Porter's Human Intellect, Spencer's Principles of Psychology, Ladd's Physiological Psychology, are used as books of reference. One essay on an assigned subject is required from each member of the class.
Four hours weekly, during January; five hours, from February 1 to April 1.

3. Ethics.

The fundamental problems of ethics and the application of moral principles to the guidance of conduct and the formation of a manly character are considered, with special reference to the Christian theory of morals. The great historic systems—hedonism, utilitarianism, intuitionism—and the relation to ethical theory of the doctrine of evolution, are discussed with the purpose of enabling the student to reach a just and intelligent view of the grounds and nature of moral obligation. The aim is to make the instruction of a directly practical nature, and to show the bearing of the problems considered upon questions of practical ethics.

The subject is taught by lectures, recitations from a text-book—Fowler's Principles of Morals, Part II, being used at present—and references to the works of Calderwood, Janet, Spencer, Martineau, Sidgwick, Stephen, Martensen, and other writers. One essay is required from each member of the class.
Five hours weekly, after April 1.

4. History of Philosophy.
Outline of Greek Philosophy.
Weekly, first half-year.
Outline of Modern Philosophy. [Optional Course.]
Weekly, second half-year.

For next year the following advanced courses in Philosophy are offered:

1. Modern Philosophy from Descartes to Kant.
Weekly, through the year. Professor GRIFFIN.

2. Modern Ethical Theories.
Fortnightly. Professor GRIFFIN.

MATHEMATICS AND ASTRONOMY.

During the coming year, Professor Simon Newcomb, LL. D., F. R. S., lately Director of the U. S. Nautical Almanac, will resume his superintendence of the work in Mathematics and Astronomy in this University. At the beginning of the session, and subsequently whenever desired, he will meet those students who desire his counsel in respect to the courses that they may follow. He will be especially interested in promoting the work of any student who desires to pursue an advanced course of study in Celestial Mechanics.

Near the beginning of the year, Professor Newcomb hopes to give a short course of lectures on the Encyclopædia of Mathematical Sciences,—a course which will be open to graduate students in Physics and Astronomy as well as to those in Mathematics.

The principal courses of systematic instruction in Mathematics will be given by Professor Craig, by Dr. Hulburt, Collegiate Professor, and by Dr. Cohen, Associate in Mathematics.

The systematic courses in Astronomy will be given by Associate Professor Poor.

A. Advanced Mathematics.

In advanced mathematics the courses below named, intended for graduate students, will be given:—

Professor CRAIG.

1. Theory of Surfaces. (*Minima Surfaces, Weingarten Surfaces, Surfaces of Constant Negative Curvature, Deformation of Surfaces.*)
Three times weekly, through the year.
2. Advanced Theory of Functions and Differential Equations.
Three times weekly, through the year.
3. Mathematical Conference.
Weekly, through the year.

Dr. COHEN.

1. Elementary Theory of Functions.
Twice weekly, through the year.
2. Theoretical Mechanics.
Twice weekly, through the year.
3. Substitution Groups.
Twice weekly, first half-year.
4. Elliptic Functions.
Three times weekly, second half-year.

B. Astronomy.

Dr. POOR offers the following courses:

1. Minor Course in Spherical and Practical Astronomy.
Twice weekly, through the year.

This course is intended for those beginning the subject. The lectures embrace the elements of spherical astronomy and the use of the ephemeris: the required laboratory work includes the use of the sextant, altazimuth, and the transit instrument.

2. Advanced Course in Spherical and Practical Astronomy.
Twice weekly, through the year.

This course includes special problems in spherical astronomy and the theory and use of astronomical instruments. The laboratory work includes the use of the meridian circle and the equatorial.

3. Theoretical Astronomy.
Twice weekly, through the year.

This course includes an elementary treatment of gravitational astronomy and of the methods of computing orbits, ephemerides, and special perturbations.

4. Special Problems in Theoretical Astronomy.
Twice weekly, through the year.

This course is intended for advanced students and will be arranged to suit their needs.

5. Exploratory Surveying.
Twice weekly, for a third of a year.

This course will be given jointly by Dr. Harry F. Reid, Associate Professor of Geological Physics, and Dr. Poor. It will include simple methods of finding geographical positions, photographic surveying, plane table surveying, etc. Practice will be had with the use of the instruments.

The Astro-Physical Seminary.
Weekly, through the year.

This will be under the direction of Dr. Ames, as announced under Physics.

Practical Work with the Instruments.
Daily, through the year.

This will be carried on by Dr. N. E. Dorsey, under the direction of Dr. Poor.

Undergraduate Course.

General Astronomy.
Two hours weekly, through the year. Dr. POOR.

This is an elective course for third-year students. It embraces an historical sketch of the development of the science, and an outline of the present state of our knowledge of the constitution and motions of the celestial bodies. The use of the principal instruments is explained, and some practice is had with the equatorial.

C. Undergraduate Mathematics.

Major Course.

Determinants.
Four hours weekly, until October 19. Professor HULBURT.

Differential and Integral Calculus (special topics).
Four hours weekly, October 20 to December 23. Professor HULBURT.

Elementary Theory of Equations.
Four hours weekly, January 3 to February 10. Professor HULBURT.

Elements of Projective Geometry.
Four hours weekly, February 14 to March 31. Professor HULBURT.

Analytic Geometry of Three Dimensions.
Four hours weekly, April 4 to the end of the year. Professor HULBURT.

Minor Course.

Analytic Geometry.
Four hours weekly, until December 23. Professor HULBURT.

Differential and Integral Calculus.
Four hours weekly, January 3 to the end of the year. Professor HULBURT.

For Candidates for Matriculation.

Algebra (special topics); Solid Geometry; Plane Trigonometry; Analytic Geometry (straight line and loci).
Four hours weekly, through the year. Dr. COHEN.

Elective Courses.

Differential Equations.
Two hours weekly, through the year. Dr. COHEN.

General Astronomy. [See above, under Astronomy.]

DEGREES CONFERRED JUNE 14, 1898.

The public exercises of Commencement were held in the Academy of Music at 4 p. m., Tuesday, June 14, 1898. Degrees were conferred on forty-three bachelors of arts, thirty-three doctors of philosophy, and twenty-two doctors of medicine, and certificates were given to nine proficients in Applied Electricity (see lists below.) The honors of the year and the recent appointments were announced by the President (see page 83 of this *Circular*.) In the evening the President and Faculty received the graduates and their friends in McCoy Hall.

Doctors of Philosophy.

Cleveland Abbe, Jr., of Washington, D. C., A. B., Harvard University, 1894. *Subjects:* Geology, Petrography, and Biology. *Dissertation:* Some Maryland Rivers and their Development: A Contribution to the Physiographic History of Maryland. *Referees on dissertation:* Professors Clark and Reid and Dr. Mathews.

Howard Bell Arbuckle, of Lewisburg, W. Va., A. B., Hampden-Sidney College, 1889. *Subjects:* Chemistry, Physiology, and Biology. *Dissertation:* A Redetermination of the Atomic Weights of Zinc and Cadmium. *Referees on dissertation:* Professors Remsen and Morse.

Arthur Henry Baxter, of Florence, Italy, A. B., Johns Hopkins University, 1894. *Subjects:* Italian, French, and History. *Dissertation:* The Introduction of Classical Metres into Italian Poetry, and their Development to the Beginning of the Nineteenth Century. *Referees on dissertation:* Professor Elliott and Dr. L. E. Menger, of Bryn Mawr College.

Ernest Julius Becker, of Baltimore, A. B., Johns Hopkins University, 1894. *Subjects:* English, German, and French. *Dissertation:* A Comparative Study of the Mediæval Visions of Heaven and Hell, with special Reference to the Visions occurring in the Literature of England. *Referees on dissertation:* Professors Bright, Browne, and Bloomfield.

Charles Hillman Brough, of Ogden, Utah, A. B., Mississippi College, 1894. *Subjects:* Economics, History, and Jurisprudence. *Dissertation:* Irrigation in Utah. *Referees on dissertation:* Professor Sherwood and Dr. Hollander.

Murray Peabody Brush, of Columbus, O., A. B., Princeton University, 1894. *Subjects:* French, Italian, and German. *Dissertation:* The *Isopo Laurensiano*, edited with Notes and an Introduction treating of the Interrelation of Italian Fable Collections. *Referees on dissertation:* Professor Elliott and Dr. Keidel.

Killis Campbell, of Enfield, Va., A. B., William and Mary College, 1894. *Subjects:* English, German, and French. *Dissertation:* A Study of the Romance of the *Seven Sages*, with special reference to the Middle English Versions. *Referees on dissertation:* Professors Bright, Browne, and Bloomfield.

Charles Gilpin Cook, of Glenville, Md., S. B., Haverford College, 1892. *Subjects:* Chemistry, Geology, and Physics. *Dissertation:* Some Double Halides of Tin with the Aliphatic Amines and with Tetramethylammonium. *Referees on dissertation:* Professors Remsen and Morse.

Frederick Henry Duryea Crane, of Montclair, N. J., A. B., Union College, 1893. *Subjects:* Chemistry, Physiology, and Physics. *Dissertation:* A Contribution to the Knowledge of Tellurium. *Referees on dissertation:* Professors Remsen and Morse.

Gilman Arthur Drew, of Newton, Iowa, S. B., Iowa State University, 1890. *Subjects:* Zoölogy, Physiology, and Botany. *Dissertation:* The Anatomy, Habits, and Embryology of Yoldia Limatula, Say. *Referees on dissertation:* Professors Brooks and Andrews.

William Alexander Eckels, of Carlisle, Pa., A. B., Dickinson College, 1883. *Subjects:* Greek, Latin, and English. *Dissertation:* Ὥστε as an Index of Style in the Orators. *Referees on dissertation:* Professors Gildersleeve and Miller.

John Eiesland, of Greenville, Pa., A. B., University of South Dakota, 1891. *Subjects:* Mathematics, Physics, and Astronomy. *Dissertation:* On a certain Class of Functions with Line-Singularities. *Referees on Dissertation:* Professors Craig and Chessin.

Charles Wilson Greene, of Stanford University, Cal., A. B., Leland Stanford Jr. University, 1892. *Subjects:* Physiology, Zoölogy, and Physics. *Dissertation:* On the Relations of the Inorganic Salts found in Blood to the Automatic Activity of a Strip of Cardiac Muscle. *Referees on Dissertation:* Professors Howell, Brooks, and Abel.

James Graham Hardy, of Easton, Pa., A. B., Lafayette College, 1894. *Subjects:* Mathematics, Physics, and History of Philosophy. *Dissertation:* On One-Variable Displacements in a Space of Four Dimensions, and on Curves of Triple Curvature. *Referees on Dissertation:* Professors Craig and Chessin.

Lancelot Minor Harris, of Bloomington, Ind., A. B., Washington and Lee University, 1888. *Subjects:* English, German, and History. *Dissertation:* Studies in the Anglo-Saxon Version of the Gospels. *Referees on dissertation:* Professors Bright and Browne.

Caleb Notbohm Harrison, of Milwaukee, Wis., B. C. E., University of Wisconsin, 1882. *Subjects:* Physics, Astronomy, and Mathematics. *Dissertation:* The Arc-Spectra of the Elements Lanthanum, Vanadium, Zirconium. *Referees on dissertation:* Professors Rowland, Ames, and Duncan.

Charles Hoeing, of Lexington, Ky., A. B., Kentucky State College, 1890. *Subjects:* Latin, Greek, and Sanskrit. *Dissertation:* The Codex Dunelmensis of Terence. *Referees on dissertation:* Professors Warren and Smith.

William App Jones, of Hillsboro, N. C., A. B., Wake Forest College, 1893. *Subjects:* Chemistry, Geology, and Mineralogy. *Dissertation:* A Contribution to the Knowledge of Dicarbonyl Cuprous Chloride. *Referees on dissertation:* Professors Remsen and Morse.

Percy Lewis Kaye, of Iowa City, Iowa, A. B., Iowa State University, 1895. *Subjects:* History, Politics, and Economics. *Dissertation:* The Colonial Executive Prior to the Restoration. *Referees on dissertation:* Professor Adams and Dr. Steiner.

Samuel Shipman Kingsbury, of Pittsburg, Pa., A. B., Marietta College, 1893. *Subjects:* Greek, Latin, and Sanskrit. *Dissertation:* A Rhetorical Study of the Style of Andocides. *Referees on dissertation:* Professors Gildersleeve and Miller.

Guy Carleton Lee, of Chapel Hill, N. C., A. B., Dickinson College, 1895. *Subjects:* History, Jurisprudence, and Politics. *Dissertation:* Hincmar: An Introduction to the Study of the Revolution in the Organization of the Church of the Ninth Century. *Referees on dissertation:* Professors Adams and Vincent.

Arthur Gray Leonard, of Oberlin, O., A. B., Oberlin College, 1889. *Subjects:* Geology, Paleontology, and Biology. *Dissertation:* The Basic Rocks of Northeastern Maryland and their Relation to the Granite. *Referees on dissertation:* Professors Clark and Reid and Dr. Mathews.

Charles Elwood Mendenhall, of Worcester, Mass., S. B., Rose Polytechnic Institute, 1894. *Subjects:* Physics, Mathematics, and Astronomy. *Dissertation:* A Bolometric Study of the Spectrum of an Absolutely Black Body between the Temperatures of 300° and 1100° Centigrade. *Referees on dissertation:* Professors Rowland, Ames, and Duncan.

Samuel Alfred Mitchell, of Kingston, Ont., A. M., Queen's University (Ont.), 1894. *Subjects:* Astronomy, Physics, and Mathematics. *Dissertation:* I. The Theory of the Concave Grating; II. Use of the Concave Grating in Stellar Spectroscopy. *Referees on dissertation:* Professors Poor and Ames.

Cleophas Cisney O'Harra, of Carthage, Ill., A. B., Carthage College, 1891. *Subjects:* Geology, Petrography, and Biology. *Dissertation:* The Geology of Allegany County, Maryland. *Referees on dissertation:* Professors Clark and Reid and Dr. Mathews.

Daniel Allen Penick, of Austin, Texas, A. B., University of Texas, 1891. *Subjects:* Greek, Latin, and Sanskrit. *Dissertation:* Herodotus in the Renascence. *Referees on dissertation:* Professors Gildersleeve and Spieker.

Thomas Dobbin Penniman, of Baltimore, A. B., Johns Hopkins University, 1892. *Subjects:* Physics, Electricity, and Astronomy. *Dissertation:* Some New Methods for the Determination and Comparison of Self Inductance, Mutual Inductance, and Capacity, together with some Actual Measurements. *Referees on dissertation:* Professors Rowland, Ames, and Duncan.

Edward Rhoads, of Germantown, Pa., S. B., Haverford College, 1893. *Subjects:* Physics, Chemistry, and Mathematics. *Dissertation:* The Effect of the Fibrous Structure of Sheet Iron on the Changes in Length accompanying its Magnetization. *Referees on dissertation:* Professors Rowland, Ames, and Duncan.

Garnett Ryland, of Richmond, Va., A. M., Richmond College, 1892. *Subjects:* Chemistry, Physics, and Mathematics. *Dissertation:* A Contribution to the Study of Liquid Mixtures of Constant Boiling Point. *Referees on dissertation:* Professors Remsen and Morse.

Aristogeiton Marcus Soho, of Annapolis, Md., Syra (Greece) Gymnasium. *Subjects:* Greek, French, and Latin. *Dissertation:* Did the Lion exist in Greece within Historic Times? *Referees on dissertation:* Professor Gildersleeve and Professor Theodore Gill, of Washington.

Charles William Waidner, of Baltimore county, A. B., Johns Hopkins University, 1896. *Subjects:* Physics, Mathematics, and Astronomy. *Dissertation:* A Recalculation of the Mechanical Equivalent of Heat. *Referees on dissertation:* Professors Rowland, Ames, and Duncan.

Richard Henry Wilson, of Baltimore, A. B., Johns Hopkins University, 1892. *Subjects:* French, Spanish, and History. *Dissertation:* The Preposition A: The Relation of its Meanings studied in Old French. *Referees on dissertation:* Professors Elliott and Rambeau.

Albert Francis Zahm, of Washington, D. C., A. M., University of Notre Dame, 1885. *Subjects:* Physics, Mathematics, and Chemistry. *Dissertation:* Determination of the Resistance of the Air at Speeds of 200 to 500 Miles an Hour, with Notes on Two New Methods of Measuring Projectile Velocities inside and outside the Gun. *Referees on dissertation:* Professors Rowland, Ames, and Duncan.

(33)

Doctors of Medicine.

William Stevenson Baer, of Baltimore, A. B., Johns Hopkins University, 1894.

William Jephtha Calvert, of Lexington, Ky., A. B., University of Kentucky, 1893, Graduate Student, Kentucky State College, 1893–94.

Patrick Joseph Cassidy, of Norwich, Conn., A. B., Yale University, 1894.

John Williams Coe, of Meriden, Conn., Ph. B., Yale University, 1893.

Percy Millard Dawson, of Montreal, Canada, A. B., Johns Hopkins University, 1894.

Arthur Wells Elting, of Upper Red Hook, N. Y., A. B., Yale University, 1894.

William Weber Ford, of Baltimore, A. B., Adelbert College, 1893.

Thomas Wood Hastings, of Morristown, N. J., A. B., Johns Hopkins University, 1894.

Alfred Birch Herrick, of Amsterdam, N. Y., A. B., Williams College, 1894.

James Hall Mason Knox, Jr., of Baltimore, A. B., Yale University, 1892, and Ph. D., 1894; A. M., Lafayette College, 1896.

Millard Langfeld, of Baltimore, A. B., Johns Hopkins University, 1893.

Gertrude Underhill Light, of Milwaukee, Wis., S. B., University of Wisconsin, 1894.

James Daniel Madison, of Mazomanie, Wis., S. B., University of Wisconsin, 1894.

Harry Taylor Marshall, of Baltimore, A. B., Johns Hopkins University, 1894.

Roger Griswold Perkins, of Schenectady, N. Y., A. B., Union College, 1893, and Harvard University, 1894.

Katherine Porter, of Baltimore, A. B., Bryn Mawr College, 1894.

Joseph Hersey Pratt, of North Middleboro, Mass., Ph. B., Yale University, 1894.

Georgiana Sands, of Port Chester, N. Y., A. B., Vassar College, 1893; Graduate Student, Barnard College (N. Y.), 1893–94.

Benjamin Robinson Schenck, of Syracuse, N. Y., A. B., Williams College, 1894.

Walter Ralph Steiner, of Baltimore, A. B., Yale University, 1892, and A. M., 1895; Graduate Student, Johns Hopkins University, 1892–94.

Emma Elizabeth Walker, of Parkersburg, W. Va., A. B., Smith College, 1887.

Andrew Henderson Whitridge, of Baltimore, S. B., Harvard University, 1894.

(22)

Bachelors of Arts.

Zadok Marshall Ballard, of Baltimore.
Odin Baltimore Bestor, of Baltimore.
Duncan Kenner Brent, of Baltimore.
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John Boswell Whitehead, of Norfolk, Va.
Jacob Forney Young, of Baltimore.

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Proficients in Applied Electricity.

George Edward Bartell, of Baltimore.

William Burke Brady, of Harrisburg, Pa., M. E., Lehigh University, 1897.

Edmund Frank, of Petersburg, Ind., S. B., Rose Polytechnic Institute, 1897.

William Schrofield Gorsuch, Jr., of Baltimore.

Richard Cameron Haldeman, of Harrisburg, Pa., A. B., Yale University, 1896.

William Lemmon Hodges, of Baltimore.

Ferdinand Brauns Keidel, of Catonsville, Md.

Bertram Motter Kershner, of Emmitsburg, Md.

Charles J. Spencer, of Baltimore.

(9)

RECENT APPOINTMENTS AND HONORS, ANNOUNCED JUNE 14, 1898.

The following promotions and appointments have recently been made by the Trustees:—

Joseph S. Ames, Ph. D., now Associate Professor, to be Professor of Physics.

Bert J. Vos, Ph. D., now Associate, to be Associate Professor of German.

Abraham Cohen, Ph. D., now Instructor, to be Associate in Mathematics.

J. Elliott Gilpin, Ph. D., now Instructor, to be Associate in Chemistry.

Harry C. Jones, Ph. D., now Instructor, to be Associate in Physical Chemistry.

Thomas S. Baker, Ph. D., now Instructor, to be Associate in German.

George C. Keidel, Ph. D., now Instructor, to be Associate in Romance Languages.

James C. Ballagh, Ph. D., now Instructor, to be Associate in History.

Also the following promotions, recommended by the Medical Faculty:

Dr. Thomas C. Gilchrist, now Associate, to be Clinical Professor of Dermatology.

Dr. J. Williams Lord, now Associate, to be Clinical Professor of Dermatology.

Dr. Louis E. Livingood, now Assistant, to be Associate in Pathology.

Adam T. Bruce Fellow.

Gilman Arthur Drew, of Newton, Iowa, S. B., Iowa State University, 1890; Ph. D., Johns Hopkins University, 1898, and late Fellow in Zoölogy.

FELLOWS.

THOMAS SEWELL ADAMS, of Baltimore, A. B., Johns Hopkins University, 1896. *Economics.*

JOHN WILLIAM BASORE, of Broadway, Va., A. B., Hampden-Sidney College, 1893. *Latin.*

FRANK RINGGOLD BLAKE, of Baltimore, A. B., Johns Hopkins University, 1897. *Sanskrit.*

PIERCE BUTLER, of New Orleans, La., A. B., Tulane University, 1892. *English.*

JOSEPH SCUDDER CHAMBERLAIN, of Hudson, O., S. B., Iowa Agricultural College, 1890. *Chemistry.*

PERCY MILLARD DAWSON, of Montreal, Canada, A. B., Johns Hopkins University, 1894, and M. D., 1898. *Physiology.*

GEORGE STRONACH FRAPS, of Raleigh, N. C., S. B., North Carolina Agricultural College, 1896. *Chemistry.*

PIERRE JOSEPH FREIN, of Gt. Barrington, Mass., A. B., Williams College, 1892. *Romance Languages.*

LEONIDAS CHALMERS GLENN, of Crowder's Creek, N. C., A. B., University of South Carolina, 1891. *Geology.*

CASWELL GRAVE, of Monrovia, Ind., S. B., Earlham College, 1895. *Zoölogy.*

KARL JOSEF GRIMM, of Baltimore. *Semitic Languages.*

HOLLISTER ADELBERT HAMILTON, of Rochester, N. Y., A. B., University of Rochester, 1892. *Greek.*

GEORGE OSCAR JAMES, of Bowers Hill, Va., A. B., Johns Hopkins University, 1895. *Mathematics.*

WILLIAM KURRELMEYER, of Baltimore, A. B., Johns Hopkins University, 1896. *German.*

JOSEPH FRANCIS MERRILL, of Richmond, Utah, S. B., University of Michigan, 1893. *Physics.*

ALFRED WILLIAM MILDEN, of Cornwall, Ont., A. B., University of Toronto, 1888. *Greek.*

EUGENE LINDSAY OPIE, of Baltimore, A. B., Johns Hopkins University, 1893, and M. D., 1897. *Pathology.*

FREDERICK ALBERT SAUNDERS, of Ottawa, Canada, A. B., University of Toronto, 1895. *Physics.*

LAURENCE FREDERICK SCHMECKEBIER, of Baltimore, A. B., Johns Hopkins University, 1896. *History.*

HENRY SKINNER WEST, of Baltimore, A. B., Johns Hopkins University, 1893. *English.*

In case a vacancy arises, THOMAS MADISON JONES, of Doe Hill, Va., A. B., Randolph Macon College, 1894, is to be appointed in the department of Latin.

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232391

[This Circular is especially devoted to Notes from the Laboratories of Biology and Geology.]

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NOTES FROM THE BIOLOGICAL LABORATORY.

Edited by WILLIAM K. BROOKS, Ph. D., LL. D.

Professor of Zoölogy in the Johns Hopkins University.

Some Ectosarcal Phenomena in the Eggs of Hydra.

By E. A. Andrews.

Since the time when the egg development of Hydra was so well described by Nikolaus Kleinenberg in his classical paper, so much has been added by the researches of Kerschner, Korotneff, Nussbaum and Brauer, that the facts recorded in this present preliminary notice would possibly not have remained unrecorded but for the fact that these later observers restricted their work so largely to the study of preserved specimens.

A careful study of the cleavage of the eggs of the green, as well as of the brown, Hydra, in March, April and May 1898, for the purpose of enquiry into the possible existence of filose phenomena,[1] revealed peculiar activities of the clear, thin, outermost, layer of the eggs—the Ectosarc. These phenomena were to some extent comparable with typical filose threads, yet characteristically different in type from those found in other forms. The eggs were studied in their normal attachment to the living parent Hydra, under a properly supported cover-glass. Artificially detached from the parent they develop very well, but are so soft that it was found difficult to place them as desired without injury; while if studied as normally attached, the movements of the Hydra although a source of much annoyance to the observer, often brought the egg into favorable positions.

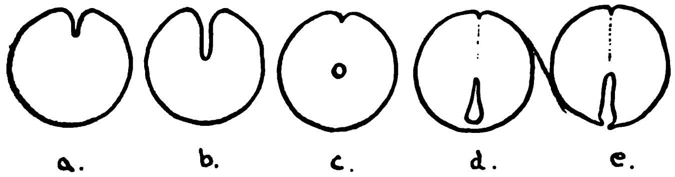

Fig. 1.

The egg divides in the remarkable manner described by Kleinenberg. The first cleavage plane passes gradually through from one side of the egg to the other, as shown in Figure 1. The groove shown in (*a*) widens and deepens (*b*) till it nearly reaches the centre, and then closes up (*c*) leaving a hole at the centre. This hole is really a passage-way quite through the egg: it seems to be the bottom of the cleavage groove left in the closing of the peripheral part. Sometimes, however, it appeared to form independently and deeper in than the groove extended. This hole seems then to move along, through the egg substance, towards the side opposite to that whence the cleavage groove started, till only a narrow isthmus of egg separates it from the surface (*d*). Here again it is not quite clear whether this part of the groove, this large passage, is exactly an enlargement of the central hole, or more or less a new formation. Finally (*e*) the isthmus parts, with withdrawal of yolk, and an open groove similar to the first part, but on the opposite side of the egg is opened up, with no isthmus now bridging it. The egg thus gapes open on one side; closes, and again gapes open on the opposite side.

The second cleavage and some subsequent ones are formed in much the same way. This cleavage is so strikingly similar to that recently described for *Beroë ovata* by Ernst Ziegler[1] as to negative his statement, (p. 41), that this mode of cleavage "*sonst nirgends in dieser Weise vorkommt.*"

Considerable complications in the cleavage are introduced by amœboid movements and the formation of pseudopodia. As shown by Kleinenberg, the first cleavage is preceded by the formation of very large blunt processes, or pseudopodia, which arise in a group at that pole of the egg farthest from the Hydra, Fig. 2. These may be compared to the "cleavage papillæ" found in the eggs of Cerebratulus[2] and occurring in eggs of some other groups. Again they are sufficiently like the "nasenähnliche Fortsätze" of Beroë to suggest some underlying common causation. They vary in size and number as well as in time of appearance and length of duration in various eggs; thus harmonizing with the great variability in other cleavage phenomena in these protean eggs. They contain some yolk spherules and

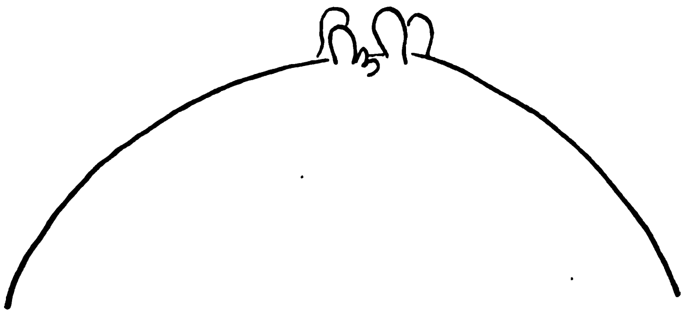

Fig. 2.

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[1] G. F. Andrews. Some Spinning Activities of Protoplasm in Starfish and Echinus Eggs. Journal of Morphology, XII, 1897.

[1] Experimentelle Studien über die Zelltheilung. Archiv. f. Entwicklungsmechanik, VII. September, 1898.

[2] E. A. Andrews. Activities of Polar Bodies of Cerebratulus. Archiv f. Entwicklungsmechanik, VI, 1898.

flow readily like sluggish pseudopodia. When the cleavage furrow opens, some papillæ, or pseudopodia, remain for some time on each edge, Fig. 3, not unlike blunt incisors in a gaping mouth.

At the time of the opening of the furrow and during its closing, there were seen much more delicate processes. These were visible as clear lines—when seen with a low power—and projected from the clear outermost part of the egg. As drawn with a camera lucida, Zeiss 4 mm. obj., and 4 eyepiece, they are represented by the black lines jutting out into the cleavage furrows in Figure 3. While the gross pseudopodia contain granular protoplasm and some yolk, these fine processes are wholly of the clear ectosarc that covers the egg external to its granular protoplasm. In the figures that follow, these ectosarcal elevations are represented by black, though under the microscope they are highly refractive and clear. Carefully observed with 4 mm. obj., and 4, 8, or sometimes 18 eyepiece, these processes seem to be sheets and masses of clear protoplasm standing out like icebergs, or icicles, or expanses of a refractive jelly.

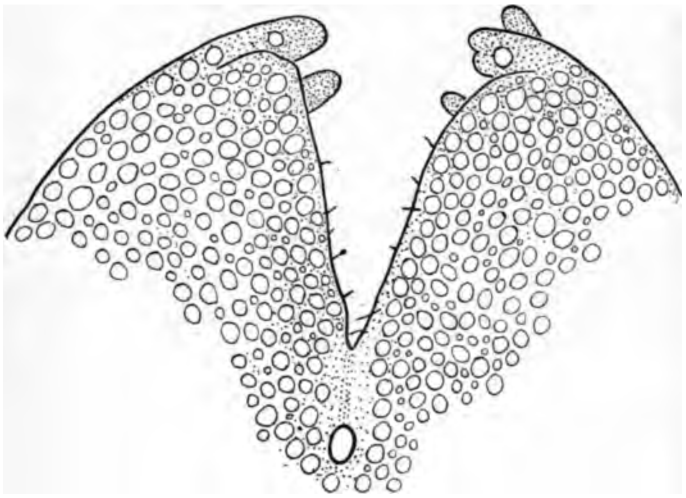

FIG. 3.

In Figure 4, some of them are represented as drawn with an interval of three minutes: the lower row of diagrams roughly shows some of the changes in size, shape, and direction at the end of that time. Often they change so rapidly that it is difficult to get sketches of the successive shapes.

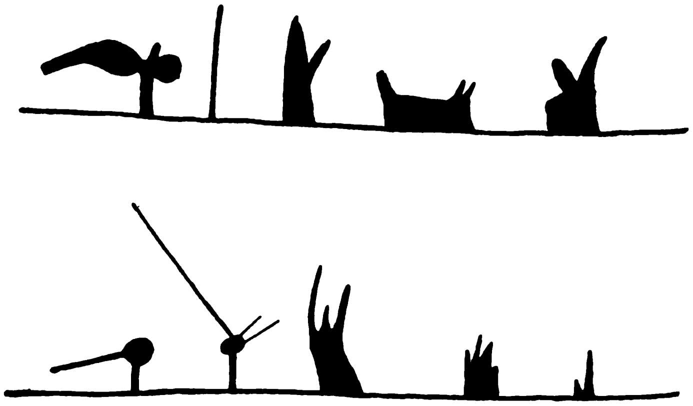

FIG. 4.

In Figure 5 are represented successive changes in one of the processes that stood out over the rim of the furrow, far from the opposite side, till the furrow had partly closed in, when it was brought into contact with the other side, or nearly so. Later it was withdrawn into the side it sprung from, and before the final closing of the furrow. The figures were drawn at intervals of about one minute and the whole series took place in about forty-five minutes. The figures indicate only the outlines of the processes in silhouette and are necessarily very imperfect since they can show no changes in density, refraction, or thickness. Moreover, in these phenomena, as in the kindred activities of certain leucocytes, it is almost impossible t follow the limits of some of the fine processes and films, even when the ligh remains constant and good The uppermost figures represent the proce figured when it appeared as a thin film, and many of its changes were du to turning the flat or the edge to view. At times it seemed to wave like flag, and then again, its edges became crenated so that it resembled certai algæ moved by a current in the water. But besides these changes, which may have been caused by outside influences, there were branchings and coalescences, increase and decrease in size, and the projection also of filament so fine as to be classed with true filose threads. Moreover, some of th movements were sudden and energetic,—thus the changes from the first t the second form shown was by a quick bend that was performed in a moment The long forked forms seen in the lower part of the diagram reached acros the cleavage furrow and their tips became indistinguishable against th opposite moiety of the egg. Apparently however, they formed no connection with it, and ultimately the whole process shrunk into a rod so minut and simple that it could have been passed by as a bacterium, had its preceding history not been observed.

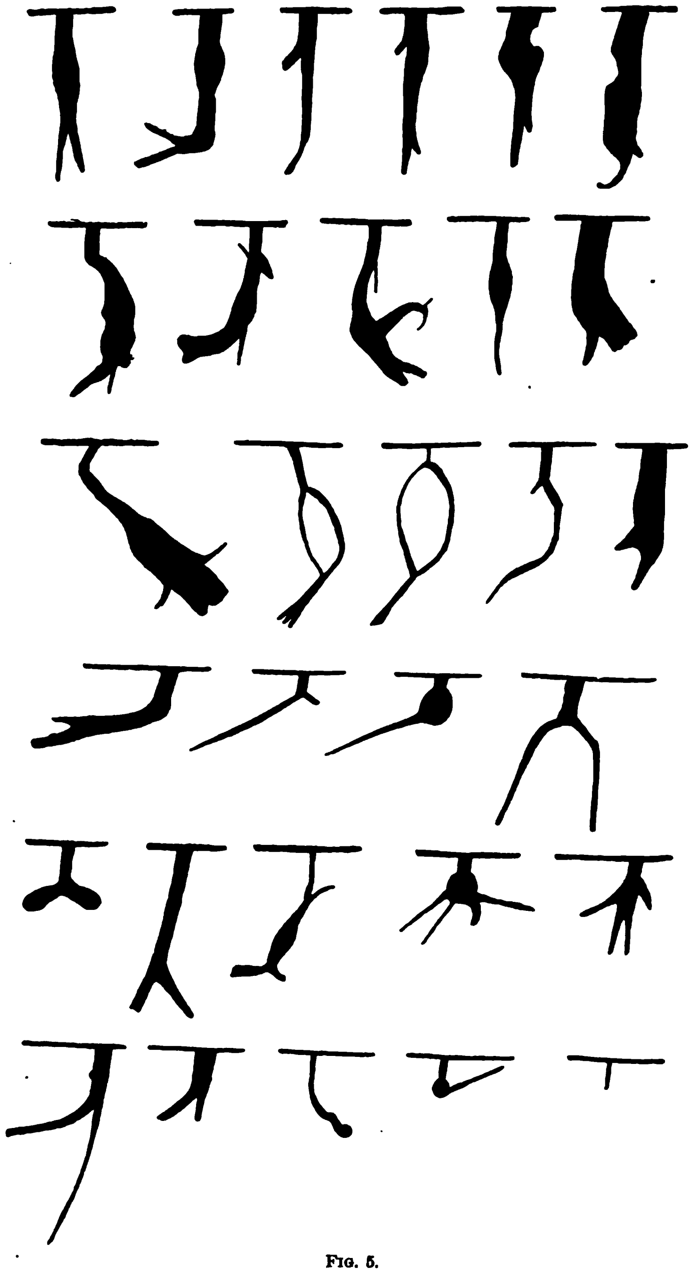

FIG. 5.

The purpose of all these protean ectosarcal displays was not at all obviou At the bottom of the cleavage furrow the processes sometimes reache

› that their tips were lost to sight over the opaque mass of the
part of the egg. Sometimes protoplasm flowed along in lumps on
›cesses, and the question suggested itself whether these ectosarcal
tablished intercellular currents as do some filose threads; but no
answer was attainable at this time. In the closing up of the furrow
›re thin expanses of granular protoplasm that passed like bandages
es from one cell half to the other, but it was not demonstrated that
d their origin in ectosarcal processes.

ι the furrow had closed and a central passage was present, phenomena
:o the above were sometimes seen, but these activities were more
indred to the gross pseudopodial formations, since granular proto-
as contained in the processes which were seen at times to shoot out
d even across, the central passage. In the later phases of the
, when the isthmus was parting (*d* and *e*, Fig. 1) there were often
iceable disturbances, both the formation of such clear ectosarcal
l processes as above described and also the shooting out of small,
ıg processes of a granular appearance.

› first cleavage, these irregularities of the surface of the isthmus
adjacent cleavage furrow, were complicated by the fact that the
tached to the ectoderm of the Hydra by irregular pseudopodia and
dergo changes at the end of the first cleavage. In later cleavages,
ing isthmus of connections was often drawn out into an exceedingly
filament that was composed almost entirely of clear ectosarc and
d a large filose thread, so that one might have thought it was pro-
›m one cell to the other had not one seen it produced as a faint
of a former gross bridge or isthmus. In the bays, or open parts
leavage furrows, near such reduced isthmuses, there were often
ive displays of both clear ectosarcal processes like those described
ıd of various granular pseudopodia both delicate and gross, some
containing yolk.

ill summarize the preceding statements as follows:

ι addition to the various granular pseudopodia that accompany the
ble cleavages of the eggs of Hydra there are peculiar disturbances
tosarc:—clear films and filaments being freely formed.

hese outgrowths of the ectosarc are formed when and where the
the egg are separated by considerable space and extend out into
ces.

hey undergo great changes of form and of bulk and may suddenly
withdraw, bend or branch.

t the bottom of cleavage furrows, when closing, such ectosarcal
ı may reach across the cleft to the opposite cell or mass. There is
›und for inferring that these processes are concerned in the approxi-
nd union of separated masses of the egg, in closing in and apparent
cleaveage products.

hese ectosarcal phenomena are akin to filose phenomena: there is
ıon to suppose them produced by such changes in the ectosarc as
resent, be spoken of only as contractility. By contractions also in
rial of the processes themselves, some, if not all, of their changes
ınd size seem to be brought about.

he presence of such activities on the surface of cleaving eggs
the value of surface tension as a factor in cleavage phenomena,
ıt explicable along the lines of any other physical explanation yet
l. On the other hand, these surface phenomena readily fall under
ıceptions of the structure and the activities of protoplasm observed
ıs adult organisms, as well as eggs and embryos, that were advanced
nt work on this subject.[1]

12th, 1898.

eview of Dr. F. S. Conant's Memoir on the Cubo-
ae. (*Memoirs Biological Laboratory, J. H. U., Vol. IV,*
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ote, which gives an outline of the memoir by the late Dr. Conant,
ıf extracts from a review, by Sidney J. Hickson, in *Natural Science;*
ı a review by Prof. H. V. Wilson, in *Science.*

(From *Natural Science*, Sept., 1898, pp. 206–209.)

e is no group of the Coelentera which needed the careful investi-
a clever student more than the one which Conant chose for the subject of his thesis for the degree of Doctor of Philosophy at the Johns Hopkins University.

"The Cubomedusae present so many features of exceptional interest that zoologists have felt very keenly that a reinvestigation of their anatomy and a study of their development were among the most important pieces of work yet to be done in the group of the Coelentera. The investigations of Claus and Haeckel, who were able to study preserved material only, are necessarily incomplete and unsatisfactory, and Conant seized the opportunity which the discovery of large numbers of the living medusae on the coast of Jamaica gave him of reinvestigating the whole subject. There can be no doubt in the minds of those who read the volume which records the results of his labors, that this contribution to science is a solid and valuable one. His descriptive writing is remarkably lucid, his reasoning clear, and at the same time cautious, and the numerous illustrations to the memoir are admirable. With such impressions framing themselves as we read the pages, there comes the feeling that in Conant we have lost a zoologist who had every prospect before him of a brilliant career in the scientific world. His patient and noble devotion to the cause he had at heart demands our admiration, and calls out our sympathy for his friends and fellow-workers in America who mourn his untimely death.

"The species that Conant had to work upon were *Charybdea xaymacana* and *Tripedalia cystophora*, both of which were found in Kingston Harbor, Jamaica, the latter being the sole representative of the new family Tripedalidae. The habit of these two species is not their least remarkable feature. The Cubomedusae were generally considered to be deep-sea forms, but both these species are found at the surface and near the shore. *Tripedalia* occurs—very locally—in water that is not only very shallow but discolored with organic matter, with a bottom of black mud.

"*Tripedalia* is the smallest form of the Cubomedusae, the height of the bell in the largest individuals being only 8 or 9 mm., whereas of the twenty species mentioned by Haeckel only two are less than 20 mm. in height. The generic name is given to it on account of the prominent feature of the arrangement of the tentacles in groups of three, with separate pedalia. Further details of the anatomy of this new genus are given in the text.

"The greater part of the dissertation is occupied by an admirably lucid account of the anatomy of *Charybdea xaymacana*, containing several new points of interest; but perhaps the most important part is the detailed description of the vascular lamellae and the nervous system of the Cubomedusae at the end of the volume. It will be noted with some interest that Schewiakoff's account of the histology of the eyes was not confirmed in all details. It will be remembered that Schewiakoff recognized in the retina two kinds of cells which he named visual cells and pigment cells respectively. This Conant was unable to do; in fact he found considerable evidence against the two types of retinal cells, and he found that the long pigment streaks are parts of retinal cells continued into processes like Schewiakoff's visual cells."

(From *Science*, Oct. 7, 1898, pp. 481–484.)

"The account of the Cubomedusan structure given by Dr. Conant is succinct but comprehensive. The deep, four-sided bell bears a tentacle (or in some species a bunch of tentacles) at each angle. On each lateral surface, at a higher level than the tentacles, is situated a niche into which projects a sense-organ. The primitively undivided (Scyphistoma condition) gastrovascular space is here differentiated into a central stomach and a peripheral portion lying in the lateral wall of the bell. The peripheral portion is subdivided into four stomach pockets by linear partitions, lying in the plane of the tentacles and therefore interradial. These partitions (cathammae) are mere strips of entodermal lamella, produced by the fusion between the entodermal linings of ex- and sub-umbrella. The cathammal lines stop short of the tentacles, leaving an undivided peripheral portion of the primitive space, by means of which the four stomach pockets communicate with one another. As Conant points out, the arrangement recalls the gastrovascular system of many Hydromedusae, with the difference that in the Cubomedusae the radial canals are wide 'stomach pockets' and the cathammal plates are narrow lines. When we come, however, to the extreme peripheral portion of the gastrovascular system, we find that the likeness is not with the Hydromedusae, but with the lobed Scyphomedusae. The gastrovascular space, to be brief, does not end with an even circular edge at the bell margin, as is the rule in the former group, but is divided into separate lobes (marginal pockets) extending into the velum (as velar canals). Conant does not dwell on phylogenetic inferences, but evidently inclines to the belief that the ancestors of the Cubomedusae possessed a margin divided into sixteen lobes. The present position of the four sense organs indicates the site of the original margin, 'which elsewhere has grown down and away from its former level, leaving the sensory clubs like floatage stranded at high-water mark.' Fusion between adjacent lobes, involving the ectoderm and jelly, gave to the medusa a continuous margin and a 'velum,' but, owing to the incompleteness in the fusion of the *entodermal linings* of the several lobes, the latter still retain in the adult Cubomedusa enough of their individuality to indicate their former condition. In a word, the marginal pockets of the existing Cubomedusa are to be construed as entodermal linings of once separate lobes.

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[1] ndrews. The Living Substance. Journal of Morphology, Vol. XII, 1897.

"This conclusion as to the morphology of the marginal pockets derives much support from the behavior of a puzzling structure, called by Conant the marginal lamella. Unlike the true vascular lamella, which simply connects one entodermal cavity with another, the marginal lamella extends from the entoderm of the gastrovascular space to the ectoderm of the bell margin. It is a narrow strip which follows the outline of the marginal pockets, travelling in the radii of the sense organs far away from the actual edge of the bell, and surrounding the sense organs in such a way as to indicate clearly that they were once at the bell margin. The marginal lamella seems to be a functionless, rudimentary organ. Claus, whose imperfect description of the structure did not bring to light its morphological interest, as indicating the site of the ancestral bell margin, suggested that it was perhaps the vestige of a ring canal. Conant naturally is skeptical of this explanation of a lamella connecting ento- and ectoderm. The true meaning of this peculiar lamella is a point well worth working up, more especially as it is not confined to the Cubomedusae, but has been observed in the ephyra lobes of discophores (*Rhizostoma*).

"Before leaving this subject of the general body-plan, it may be mentioned that while the probability is that the Cubomedusae are descended from stalked ancestors (*Lucernaria*-like forms), and hence that the apex of the exumbrella was once drawn out into a peduncle, there is in the adult Cubomedusa no trace externally nor internally of this hypothetical stalked condition. Light on this very interesting point can only be expected from a study of the development.

"Unlike the other Scyphomedusae studied, the Cubomedusae possess a nerve ring. In their study of the nervous system Claus and Conant both depended on sections, and naturally the results are not so satisfactory as those reached by the Hertwigs on the Hydromedusae mainly with the aid of macerations. Claus describes the neuro-epithelium as consisting of alternating supporting cells and sensory cells, the inner ends of the latter becoming continuous with the nerve fibres. Conant makes it doubtful whether this is the actual condition, since he does not find the sensory cells. He offers, however, no observations on the origin of the 'nerve fibres.' Macerations will probably show the connection of these fibres with at least some of the neuro-epithelium cells.

"The possession of a nerve ring has been regarded (Claus) as a point of essential similarity between the Cubomedusae and the Craspedota. The main ring in the former group is obviously a differentiation of the epithelium of the subumbrella, and Claus, therefore, interprets it as homologous with the inner Craspedote ring. In the immediate neighborhood of each sense organ there are given off from the main ring two roots which *ceasing to be superficial bands* pass through the jelly, and emerge on the outer wall of the bell (on the floor of the sensory niche). They converge and unite, forming a superficial nerve tract which crosses the base of the sense-club. These four isolated tracts are regarded by Claus as the remnants of a once continuous exumbral ring, such as is found in the Hydromedusae, and which here, as in the Hydromedusae, stands in connection with the subumbral ring through the medium of fibres that perforate the jelly. Conant, on the other hand, regards the tracts lying across the bases of the sense organs as portions of the primitive subumbral ring which were shut off from the main ring when the marginal lobes grew together. With the Hertwigs and Haeckel he thus looks on the ring as not homologous with that of the Craspedota, but as a special differentiation of the plexus of the subumbrella, found throughout the Scyphomedusae."

The Echinoids and Asteroids of Jamaica.

By HUBERT LYMAN CLARK.

While enjoying the privileges of the Marine Laboratory of the Johns Hopkins University at Port Henderson, Jamaica, in 1896, and again at Port Antonio, in 1897, I felt the need of some means of identifying the Echinoderms which we found. Collections were made of all the species found, and upon these the following list is based, though I have had the opportunity of examining in addition the collections, now in the Appleton Cabinet of Amherst College, made in Jamaica some forty years ago by Prof. C. B. Adams. My own collections were made in Kingston Harbor, chiefly near Port Royal, and on the Cays which lie off its entrance on the south side of the island, and at Montego Bay and Port Antonio on the north side. They were made during the months of May, June and July, 1896, and July and August, 1897. The Ophiurids have been placed in other hands for identification, while the Holothurians, which in those waters are the most numerous and noticeable of the Echinoderms, will be treated of in a later paper.

This list of Echinoids and Asteroids is not supposed to be exhaustive, as very little dredging was done, and none at all in water over six or seven fathoms deep, but it is hoped that it may be of use in two ways. Primarily in making the identification of the different species easy for future students and visitors to the island, and secondarily in throwing some light on the distribution of the littoral Echinoderms in the West Indies. The paper by Dr. G. W. Field in the Johns Hopkins University *Circular* for April, 1892, on the "Echinoderms of Kingston Harbor," has been of the greatest assistance in the preparation of this somewhat more extended list.

THE ECHINOIDS.

The identification of the Echinoids has been made easy by the works of Professor Alexander Agassiz. Sea-urchins are abundant everywhere that I have been on the coast of Jamaica, though the number of species is small, but Clypeastroids and Spatangoids are not common on the south side of the island.

Order: Cidaroida.

Family: Cidaridae.

1. *Cidaris tribuloides* (Lamk.).

Easily recognized by its thick, blunt spines, which are often overgrown with animal or vegetable incrustations. Natural color, reddish or purplish brown; secondary spines almost white, with dark brown tips. Size medium, the test seldom exceeding 60 mm. in diameter. Common on the Cays near Kingston, where the specimens usually have the spines quite clean. Very abundant at Port Antonio, especially in East Harbor, and there the spines are very much overgrown with Algae. The reproductive organs were not near maturity in any specimen examined.

Order: Diadematoida.

Family: Diadematidae.

2. *Diadema setosum* (Gray).

Readily distinguished from the other sea-urchins by its very long, slender spines, large size and dark color. The test may be 100 mm. in diameter and the spines twice that in length. The color is usually a very dark reddish or purplish brown, almost black, but specimens are common which have the spines banded brown and white, and sometimes almost wholly white specimens are found. Light color seems to be especially characteristic of very small, presumably young specimens. Abundant about coral reefs everywhere in Jamaica.

Family: Echinometradae.

3. *Echinometra subangularis* (Leske).

Very variable in size and shape, as well as in color. Ambitus sometimes circular, but usually elliptical, with a long diameter of about 60 mm. and a short one of 53. Test somewhat flattened. Spines rather stout, but sharp pointed. Color varies from very light to very dark reddish brown, while the spines often appear iridescent violet-green. Abundant on the Port Henderson side of Kingston Harbor, but especially so in the East Harbor at Port Antonio, near Folly Point.

4. *E. viridis* (A. Ag.).

Similar to the foregoing, but may be distinguished by the "bare abactinal system with equally developed genital plates." I have not met with this species myself, but there are several specimens from Jamaica in the Adams collection, and I feel confident that a careful search would show it to be more or less common in the same situations as *E. subangularis*.

Family: Echinidae.

5. *Toxopneustes varieagatus* (Lamk.).

Readily distinguished by its green and white coloration, though the spines are often tipped with purplish, and rarely they are wholly white. Test about 70 mm. in diameter,

lattened; ambitus circular. Very abundant in Kingston Harbor everywhere.
places the bottom seems literally paved with them. In three hauls of a small
ff Port Henderson, 856 specimens were obtained. Much less common on the
e of the island, but a few specimens were met with in the East Harbor at Port
Sexual products are ripe all summer and artificial fertilization is extremely

onoë esculenta (Leske).

rge size and light color of this urchin easily distinguishes it from the other
Echinoids. Test usually delicate purplish, 100 to 125 mm. in diameter. Spines
hite, closely crowded. Very small specimens often are rather yellowish and
be confused with *Toxopneustes*, but they may be recognized by the absence of
ricating plates on the buccal membrane. Common on the Cays near Kingston,
Rackum Cay. Very common at Port Antonio, especially in East Harbor near
int. Sexual products were ripe in June and July, and artificial fertilization
ssful.

Order: Clypeastroida.

Family: Clypeastridae.

easter subdepressus (Gray).

by the colored boys "sea-moon." Recognized by the very flat actinal surface
hinness in proportion to length and breadth. My best specimen measures 175
ength, 135 in breadth and only 25 in greatest thickness. Agassiz says, however,
proportions vary greatly. Color, yellowish green, deep brown or rich dark
purple. Three fine specimens were obtained in Kingston Harbor, near Fort
, and I collected on the reef at Port Antonio a small clypeastroid which, with
itation, I refer to this species.

nanthus rosaceus (Lamk.).

distinguished by its highly arched test and deeply sunken mouth. My best
measures 76 mm. in length, 62 in breadth and 33 in height; the mouth is sunk
elow the edge of the test. Color, uniform dark brown. Not seen alive on the
de of the island, but several specimens were taken at Port Antonio, on the
st side of Navy Island. They were found in the sand underneath large slabs of
k.

Family: Scutellidae.

ita sexforis (A. Ag.).

lelicate "sand-dollar" may be known by the flatness of the test and the *six*
The color of the living animals is a light olive-green. My largest specimen is
ircular, and has a diameter of 55 mm. Not seen about Kingston, but quite
in the East Harbor at Port Antonio.

testudinata (Klein).

guished from the foregoing by being more highly arched and having only *five*
I did not meet with this species myself, but a handsome bleached test (65 x 50
om Jamaica is in the Adams collection.

Order: Spatangoida.

Family: Echinoneidae.

hinoneus semilunaris (Gmel.).

ical, somewhat flattened Echinoid, with five equal, simple, narrow ambulacra,
ng from apex to mouth. In living specimens the spines are light brown, while
are usually bright red, causing the ambulacra to appear with great distinctness.
the specimens found were less than 25 mm. long, but one test measures 46 x 37
his species is found, though not very common, on Rackum and Drunkenman's
ar Kingston, but it is abundant at Port Antonio, especially on the Fort Reef.
cur usually in the sand beneath broken slabs of coral rock, though they some-
ing to the underside of the rock itself. They can burrow in the sand with some
, and are easily overlooked. The sexual products seemed to be ripe early in

Family: Spantangidae.

issus unicolor (Klein).

spatangoids of small size and uniform light grayish brown color. Large speci-
easure about 80 mm. long, 65 wide and 42 high, but most of those found were
ch smaller. Not seen on the south side of the island, but very common at Port
, in company with the foregoing, which in habits it somewhat resembles.

oma ventricosa (Lamk.).

nized at once by its large size. Near Kingston it occurs in water of two or three
depth on the harbor side of Drunkenman's Cay, just outside the reef, where we
a dozen specimens in two hauls of a small dredge. At Port Antonio they were
n two fathoms of water on the sandy bottom directly south of Navy Island,
hey were obtained by diving for them. Superficially, the specimens from these
alities are so different, I can hardly convince myself they are the same species.
rom Drunkenman's Cay are dark brown, and measure about 95 mm. long, 75
nd 40 high, while the specimens from Port Antonio are twice as large, more
arched, and of rather a light yellowish brown color.

THE ASTEROIDS.

identification of the star-fish collected has been a matter of no little
lty, owing to the lack of good descriptions and figures of the West
littoral forms. Star-fish are not abundant at any point in Jamaica
have visited, though one or two species are reasonably common at Port Royal. I feel sure that careful search and a little dredging would add materially to the following list.

Order: Phanerozonia.

Family: Astropectenidae.

Astropecten.

The Jamaican species of this genus may be easily recognized by the very flat abactinal surface, covered with paxillae, the very large and prominent marginal plates, and the light color. They are of medium size, generally less than 125 mm. across, and are usually reddish or yellowish white, but often a light greenish gray.

1. *A. articulatus* (Say).

This species may be recognized by the absence of spines on the superior marginal plates, but near the distal end of the ray each of these plates bears a single, small, blunt tubercle. The tops of the paxillae are granular, and the long spines on the inferior marginal plates are blunt and much flattened. Occurs in Kingston Harbor, chiefly near Port Royal, and also at Montego Bay, but no Astropectens were found at Port Antonio. The specimens obtained were collected on sandy bottom, in very shallow water, among or near mangroves.

2. *A. duplicatus* (Gray).

Distinguished by the long, sharp, conical, erect spines on the superior marginal plates. Tops of the paxillae with 8 or 9 rather long blunt spines. Not uncommon in Kingston Harbor, near Port Royal, on sandy bottom, in very shallow water, near mangroves. Not seen on the north side of the island.

3. *A. antillensis* (Lütken.).

In the Adams collection there are several specimens of Astropecten, labelled "Astropecten antillensis, Jamaica," which differ from the foregoing species in the absence of spines and tubercles on the superior marginal plates. The spines on the inferior marginal plates are somewhat cylindrical, and the tops of the paxillae are granular. While these specimens, which are in a wretched state of preservation, may be *articulatus*, *antillensis* probably occurs in Jamaica, and I feel no hesitation in including it in this list.

Luidia.

Star-fish of this genus may be distinguished from those of the preceding by the absence of the prominent superior marginal plates. They are also considerably larger, and the rays are much longer in proportion to the size of the disc.

4. *L. alternata* (Say).

Large star-fish, 250 mm. across, of a dark olive green or a purplish color above, with irregular yellowish bands across the rays, and the actinal surface entirely yellow. Paxillae rather small, closely crowded, bearing numerous spines, of which the central one is most evident, especially along the sides of the ray, where they are very prominent. Lower surface very spiny. Abactinal surface somewhat flattened. Rays five, considerably arched. A single specimen of this handsome star-fish was collected on muddy bottom near the mangroves at Port Royal.

5. *L. clathrata* (Say).

Easily recognized by the bluish gray color of the flattened abactinal surface and the closely crowded granular paxillae. The latter, especially those in the two rows on the outer edges of the rays, have almost rectangular tops, and bear numerous granules or short blunt spines of uniform length. The actinal surface is very light yellowish or white. Rays, five. Whole star-fish about 200 mm. across. Rather common about Port Royal, on saady bottom, near mangroves, but not seen on the north side of the island. Two specimens in the Adams collection, labelled "Luidia clathrata, Jamaica," differ very plainly from those I collected at Port Royal. The abactinal surface of the rays is much more convex, and the spines of the actinal surface are quite different in size and shape. The paxillae, moreover, bear about 8 or 9 short blunt spines, instead of about 15 large granules. I think it very possible that there are two *clathrata*-like species occurring in Jamaica.

6. *L. senegalensis* (Lamk.).

In general appearance similar to *clathrata*, but readily distinguished by having *nine* rays. The single specimen of this remarkable star-fish which I collected measures nearly 300 mm. across. It was found near Port Royal on sandy bottom. A few days later the imprint in the sand of another specimen was noticed near the same place. Dr. Field speaks of two specimens of a star-fish which he thinks belonged to this species, being dredged in Kingston Harbor, off Fort Augusta, so I am inclined to think it is probably not rare on the south side of the island.

Family: Pentagonasteridae.

7. *Pentagonaster parvus* (Perrier).

It is only after a great deal of hesitation that I refer to this species, a very small pentagonal star-fish, collected while dredging on muddy bottom in about ten feet of water, in the East Harbor at Port Antonio. When living, the flat abactinal surface was dark olive green and the actinal surface almost white, but alcohol has entirely destroyed the color. The size is much less, but the proportions about the same as in Perrier's type of *parvus*, and the number of marginal plates is the same.

$$R = 5\tfrac{1}{2}\text{ mm. } r = 3\tfrac{1}{2}\text{ mm. Mar. pl. } \frac{9\text{–}10}{8\text{–}10}.$$

The marginal plates are large and thickly covered with granules. The adambulacral plates carry four blunt spines on their free margins and one prominent spine on the actinal surface. The abactinal surface is very granular. Although the identification of this little asteroid is not entirely satisfactory, I do not feel inclined to base a new species on a single small specimen.

Family: Pentacerotidae.

8. *Pentaceros reticulatus* (L.).

This familiar West Indian star-fish may be readily distinguished by its size, shape and color. It is decidedly pentagonal, though the rays are evident and the abactinal surface is highly arched and covered with knobs and tubercles. The color is orange red of some shade, often becoming brown in dried specimens. It is the largest of the Jamaican Asteroids, and some individuals reach a diameter of 500 mm., while 300 mm. is a common size. Plentiful in Kingston Harbor, but rather rare at Port Antonio. Only two specimens were seen there, and those were on muddy bottom in East Harbor.

Family: Asterinidae.

Asterina.

The Jamaican species of this genus may be recognized by their small size, distinctly pentagonal shape, and the presence of spines on the interradial plates of the actinal surface. This little star-fish occurs on the under side of the rocks about the reefs, but so closely do they cling, and their coloration harmonizes so with their surroundings, they might easily be overlooked.

9. *A. folium* (Lütk.).

Distinguished by the proportions and arrangement of the spines.

$R = 8$ mm. $r = 7$. $\therefore r = .8.75\ R$, or
$R = 6\frac{1}{2}$ mm. $r = 6$. $\therefore r = .923\ R$.

Adambulacral plates with 4–5 spines on the free margin and 3 on the actinal surface; interradial plates with 3–4 spines on each; and inferior marginals with numerous fine spines on the outer edge. My largest specimen is 18 mm. across. The color of this species varies greatly, the commonest shades being blue, reddish yellow, green and almost white. Common on the broken slabs of coral rock at Drunkenman Cay, and also found at Rackum Cay. On the north side of the island, the only specimen seen was collected at Port Antonio.

10. *A. minuta* (Gray).

Specimens of this star-fish are easily separated from the preceding by their smaller size, less distinctly pentagonal shape, and the arrangement of the spines. My largest specimen is only 12 mm. across.

$R = 5$ mm. $r = 4$. $\therefore r = .800\ R$.

Adambulacral plates with 2–3 spines on the free margin and 2 on the actinal surface; interradial plates with only a single spine (rarely 2), and inferior marginals with a single series of about 10 rather long spines on their outer edge. Color almost white, with little variation. Very common on the Fort Reef at Port Antonio and on other reefs about that harbor, but no specimens were taken on the south side of the island.

There can be no doubt, I think, that Sladen (*Challenger Reports*, Vol. XXX, page 393) is right in rejecting Perrier's conclusion (*Arch. de Zool. Exp.*, Vol. V, 1876, page 229) that *folium* is a synonym of *minuta*. I can find no evidence of any intergradations between the two species, my smallest specimens of *folium* showing all the characters of that species. It is interesting to note also that *minuta* seems to characterize the north-side fauna, while *folium* is much more distinctive of the south side of the island.

11. *Stegnaster wesseli* (Per.).

Another pentagonal star-fish occurs on the reefs at Port Antonio, though I did not see it elsewhere. It is readily distinguished from either of the preceding by being covered with a thick and very granular skin. The adambulacral plates bear 3 spines on their free edge and the oval plates bear 5 or 6 closely crowded long spines, but these are all hidden by the margin of skin which overlaps the mouth and ambulacral furrows. The interradial plates in large specimens bear 4 or 5 distinct spines, somewhat hidden by the thickness of the skin, but in smaller specimens these could not be detected. Inferior marginal plates bear numerous very short, sharp spines on their outer edge. In shape this species is much more highly arched than either of the preceding. The largest specimen taken was 35 mm. across and 7 mm. high. $R = 20$. $r = 18$. $\therefore r = .900\ R$. A number of specimens of this star-fish were collected on the Fort Reef at Port Antonio in company with *Asterina*, *Ophidiaster* and *Linckia*. I am indebted to Professor A. E. Verrill for the identification of this species, my specimens of which do not wholly agree with Perrier's original description.

Order: Cryptozonia.

Family: Linckiadae.

12. *Ophidiaster guildingii* (Gray).

Rays rather long and almost cylindrical. Papulae arranged in group in regular longitudinal rows on the upper side of the anus. Color varies from orange red, with irregular yellow markings, to purplish brown, with blotches of dirty white. Size usually rather small, 60–70 mm. across; rays 25–30 mm. long. Not seen on the south side of the island, but fairly common on the Fort Reef at Port Antonio, occurring in crevices in the coral rock. All the specimens taken have five perfect and approximately equal rays.

13. *Linckia guildingii* (Gray).

Rays somewhat more flattened than in *Ophidiaster*. Papulae in groups, scattered irregularly all over the abactinal surface. Color of large specimens bright yellowish brown, but smaller specimens are darker, almost a chocolate brown, with a shade of purplish; rarely blotched with a lighter shade. Size usually medium, but one specimen was found 200–250 mm. across. Occurs rarely among the corals on the south side, but is quite common at Port Antonio in the crevices of the reef and broken rock. Rays, sometimes 5, but often 6, and very rarely equally or symmetrically developed. A number of specimens were collected showing the disc and four small rays growing out from the end of a large ray, and sometimes single rays were found alive and moving, with no signs of a recent separation from the disc.

Family: Echinasteridae.

14. *Echinaster spinosus* (Retz.).

Easily recognized by the bright red color and the spiny projections on the abactinal surface. Size medium, about 160 mm. across, with rays 65 mm. long. Found on muddy bottoms among the mangroves. Very common at Port Royal, and seen at Montego Bay, but none were found at Port Antonio.

AMHERST COLLEGE, *January*, 1898.

Embryology of Ophiocoma echinata, Agassiz. Preliminary Note. By C. GRAVE.

The conflicting results of previous investigators, and the need of confirmation of some of the results obtained by them upon ophiurid development seemed to warrant my undertaking a new investigation of the subject, and by the advice of Prof. W. K. Brooks it was made my principal object while in Jamaica during the Summer of 1897, to obtain a series of embryological material extending at least from the segmentation stages to the beginning of metamorphosis.

But when I arrived at Port Antonio on June 14th, I found that in no species at hand had the breeding season begun except with Ophiocoma Riisei with which it was over, and it was not until less than three weeks of the end of my stay that the first ripe eggs were thrown by Ophiocoma echinata although ripe spermatozoa had been obtained every day for more than a month.

In consequence of this the oldest plutei reared were but sixteen days old and showed no signs of metamorphosis, but probably had reached their adult form and size.

The eggs, which were of an orange red color, after being fertilized threw about themselves a tough prickly egg membrane which rendered preservation difficult until it was burst and the larva had escaped.

At first the points and ridges of this clutinous egg membrane were quite high and regular, but soon were worn down and became as shown in Figure 1. Under the outer egg membrane is still another, very thin and closely applied to the developing larva.

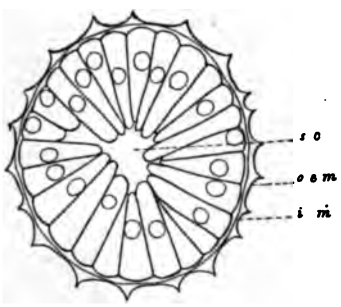

FIG. 1.

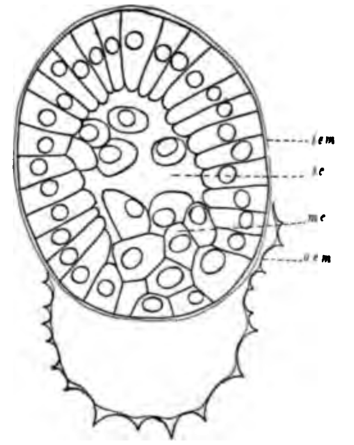

FIG. 2.

Segmentation was regular and a blastula was formed, consisting of cells of equal size or nearly so, and with a very small segmentation cavity. The long cylindrical cells composing its walls before dividing flatten down and become as nearly spherical as conditions will admit, as has been described by Korschelt for sea urchins and as is shown for O. echinata in Figure 1, which is a camera sketch of a section of a blastula. The growing larva now bursts the chitinous membrane which encloses it, crawls out and swims about in the water. It is somewhat elongated and swims in the direction of the axis connecting the animal and vegetable poles, the animal pole, which is slightly pointed, preceding.

As it moves from place to place, it is continually revolving on the long axis. At the time of hatching, the mesenchyme formation has just begun. It takes place by the rapid proliferation of cells at the vegetable pole, no evidence being found of its originating as two bands, and is continued until the segmentation cavity is quite crowded with cells. Figure 2, is a camera sketch of a section of a larva at the time of hatching, cutting it in the plane of the long axis, showing the shape of the larva at this stage and the method of mesenchyme formation.

The cilia did not show in the section, but those at the animal pole are much longer than those over the rest of the larva.

The gastrula stage is formed several hours later by the invagination of the vegetable pole. The cells composing the invaginated tube or archenteron are all of about the same shape and size, but a decided differentiation is to be noted among the ectoderm cells. Those at the animal pole are much elongated and vacuolated thus forming a thickened apical plate. The walls too have each a thickened area, while the cells of the ventral e of a uniform thickness, but much thicker than those composing the surface of the larva which are much flattened and thin. Near the ied lateral areas, clumps of mesenchyme cells collect and begin to the larval skeleton. Beside these, other mesenchyme cells take up iction, probably, of support for the archenteron and other organs as rm. At least in gastrulae and older larvae, long branching cells can 1 in the segmentation cavity connecting the archenteron with the m wall, or with other mesenchyme cells, or connecting two portions ectoderm. The cells of the supported parts to which the processes of senchyme cells attach, take an active part in the formation of the ting fiber, or strand, as part of their substance meets and fuses with nt out by the mesenchyme cell.

n the apex of the flattened archenteron a pair of pouches grow out e constricted off, one to the right the other to the left. Each of these into two pouches of about equal size, one of which remains in about inal position while the other migrates toward the blastophore and p a position on the side of that part of the archenteron which will ecome the stomach. This is as Metschnikoff described it, and as upposed must be the case, but contrary to what both the above intors describe, I find that the right posterior pouch degenerates and ears, thus leaving a larva with a pouch on either side of the oesopha-l one on the left side of the stomach. This condition was noted in pluteus observed, and hundreds of them have been studied.

onfirmation of the phenomenon observed in ophiurans by Metsch- and in starfish larvae by Brooks and Field, I find that soon after ormation, the two anterior pouches both communicate with the ex- hrough pore canals which open on the dorsal surface of the larva.

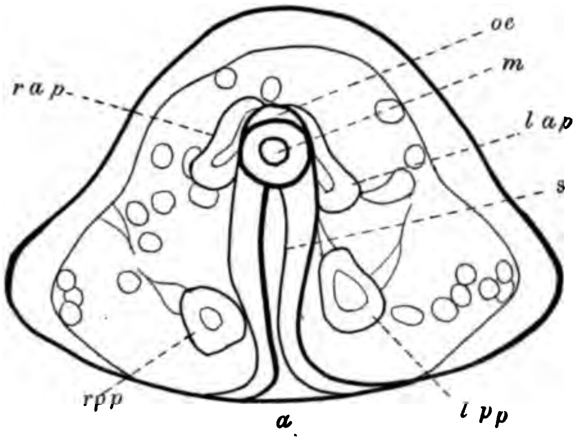

FIG. 3.

ibout the time of the formation of the pore canals or a little before, val mouth breaks through on the ventral surface and there is formed rfect bilaterally symmetrical larva shown in Fig. 3, which is the section of a larva lying on its dorsal surface, the outlines having iade with a camera lucida.

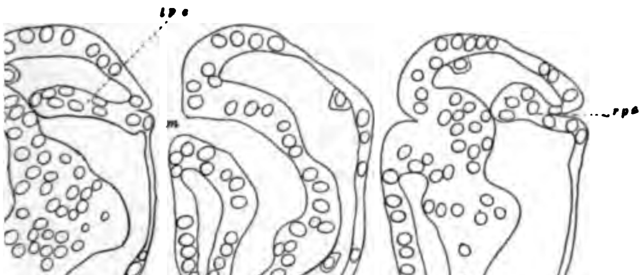

FIG. 4.

pore canals are not, as Bury describes, intracellular structures but in an epithelium of flattened cells as is shown by Figs. 4, and 5, are camera drawings of sections of two larvae. Fig. 4, represents the 17th, 21st, and 24th longitudinal sections of a young larva, the 17th section passing through the edge of the alimentary canal and left pore canal, the 21st being the median sagittal section and passing through the mouth and anus, the 24th cutting the larva in the plane of the right pore canal. Fig. 5, is a transverse section through the oesophagus of a slightly older larva cutting both pore canal openings.

The abundance of apparently normal larvae having two pore canals indicates that it is a normal condition of larvae of that stage, which, should it so prove to be, would probably constitute a character of some phylogenetic importance. The right pore canal sooner or later disappears, but persists slightly longer than the right posterior pouch which is very transient in its character.

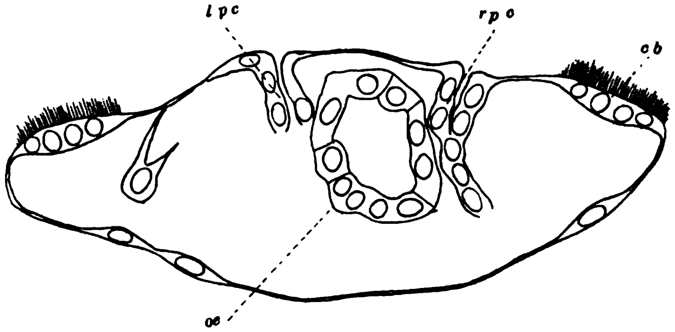

FIG. 5.

With the exception of the arms, which become very long, and the skeleton, which has been dissolved out, the pluteus, after undergoing the above transformations, appears as shown in Fig. 6, which is the optical section of a young pluteus made in the same manner as Fig. 3, but in this case the pluteus is lying on its ventral surface.

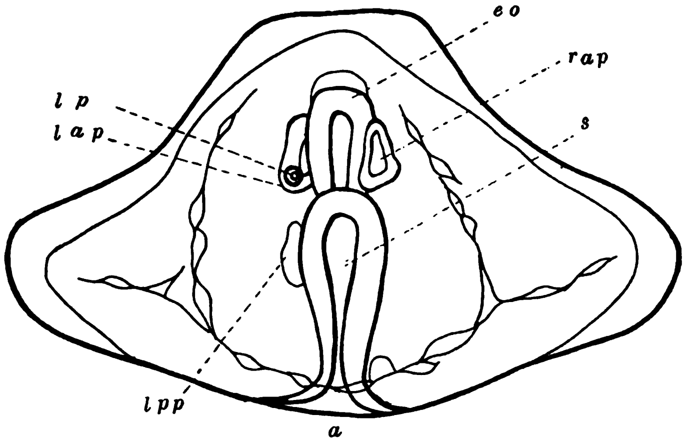

FIG. 6.

EXPLANATION OF LETTERS IN FIGURES.

A.—Anus.
Cb.—Ciliated band.
Iem.—Inner egg membrane.
Lap.—Left anterior pouch.
Lpc.—Left pore canal.
Lpp.—Left posterior pouch.
M.—Mouth.
Me.—Mesenchyme.
Oe.—Oesophagus.
Oem.—Outer egg membrane.
Rap.—Right anterior pouch.
Rpp.—Right posterior pouch.
Rpc.—Right pore canal.
S.—Stomach.
Sc.—Segmentation Cavity.

Notes on the Ophiurids collected in Jamaica during June and July, 1897. By CASWELL GRAVE.

During the summer of 1897, while I was working at the Johns Hopkins Biological Laboratory stationed in Port Antonio, Jamaica, I improved the opportunity of collecting the Ophiurids found in that locality.

Up to the present time five species only have been noted from the island, and these from Port Henderson, on the south side. One of the just mentioned list, *Ophiocoma aethiops*, does not occur as described, but *O.*

echinata is very abundant in that locality and probably is the species referred to as aethiops.

No attempt at detailed descriptions is made in this note, but only the habitat and such general characters of each species are given as will aid students in finding and identifying the specimens at the seashore.

The numbers immediately following the name of each species refer to the pages in Theodore Lyman's works on Ophiurids where a detailed description of the species in question will be found or a reference to such a description. The first numbers refer to the Challenger Report, the second to Part I of the Illustrated Catalogue of the Museum of Comparative Zoology of Harvard College for 1865.

I. *Ophiocoma*, Agas.

This genus is characterized by a granular disk; covered radial shields; the possession of both tooth and mouth papillae, the former being numerous and arranged in a vertical clump; arm spines smooth, solid and rather stout, 4–6 in number; two genital openings in each interbrachial space.

1. *Ophiocoma echinata*, Agas. 167–169, 81–83. This is the largest brittle star found in Jamaica, measuring 3.2 cm. across the disk. It occurs everywhere, but is especially abundant on the shallow reefs under loose stones, which afford it a hiding place during the day. The small young specimens are most plentifully found by tearing up the calcarious algae which grow on the reefs. The general color of the species is grayish; the disk, however, varies much in its markings, a dark star in its center being quite common. The arms are spiny and usually banded with dark. The breeding season begins toward the end of July.

2. *Ophiocoma Riseii*, Ltk. 167, 76–77. Found with No. 1, with which it agrees in size and form. The general color is black above, but the reddish orange foot tentacles give the under side a reddish appearance. It breeds early, probably in April and May.

3. *Ophiocoma pumilla*, Ltk. 168–171, ———, ———. Found also with No. 1. Medium in size, 1.2 cm. across disk; very long, slender, spiny arms, which are banded with dark, the general color of the species being a light brownish yellow. In June and July, when examined, the gonads were small and immature.

II. *Ophiura*, Lmk.

The disk in this genus is also granular, but the granulations are much smaller than in Ophiocoma; mouth papillae numerous; arm spines 7–13 to each side of each joint, smooth and shorter than the arm joints; four genital openings to each interbrachial space.

4. *Ophiura appressa*, Say. 8–9, 34–35. Found under the same stones with No. 1. Medium in size, the average diameter of the disk being 1.4 cm. General color brown, variegated with green, red and white. Arms round, banded with dark; 8–9 very small spines on the side of each vertebra, the lowest of which are longest. During July the eggs were large and much pigmented, probably breeding in August.

5. *Ophiura brevicauda*, Lyman. 8–9, 16–18. Found with No. 1. Average diameter of disk, 1.4 cm. Color greenish, variegated with white and brown. The specimens keep their color well in alcohol. The arms are much stouter than in No. 4, and the 8–10 arm spines are short, stout and equal in length.

6. *Ophiura guttata*, Lyman. 8–9, 10–20. Slightly larger than No. 4, with which it is found. This species is easy to recognize by the bright yellow under surface of the arms. The upper surface of the arms and disk are dark. The 9–10 arm spines are slender and equal in length.

7. *Ophiura brevispina*, Say. 8–9, 16–19. Same size as No. 4, and difficult to distinguish from it, both being found together. The 7–8 arm spines are equal in length, and the color is a little more greenish than in No. 4.

III. *Ophioneris*, Ltk.

Disk covered with fine overlapping scales, which nearly cover the radial shields; 3–5 smooth arm spines on either side of each vertebra; a supplementary piece on each side of each upper arm plate; two genital openings in each interbrachial space.

8. *Ophioneris reticulata*, Stk. 160–162, 140–142. About the same size, color and form as No. 3, with which it is found, but easily distinguished from it by the disks being reticulated with small dark lines. Gonads immature in June and July.

IV. *Ophiolepis*, Müll and Trosch.

Disk covered with radial shields and stout plates, each larger one being surrounded by a row of small ones; arm spines short and small, supplementary pieces to upper arm plates; two genital openings in each interbrachial space.

9. *Ophiolepis paucespina*, Müll and Trosch. 18–20, 55–57. Found by tearing in pieces the calcarious algae which grow on the Fort Reef. Its color is the same as the light-colored sand and algae on which it lives. This is a very small species, the disk seldom exceeding .5 cm. in diameter. The arms are short and round. Gonads immature in June and July.

10. *Ophiolepis elegans*, Ltk. 18–19, 55–59. Diameter of disk, 1.2 cm. Under surface pure white and covered with large irregular plates. A beautiful Ophiurid, and found quite plentifully by dredging the West Channel of West Harbor. Sexually immature when examined in June and July.

11. *Ophiolepis impressa*, Ltk. 18–19, 55. The average diameter of the disk of this species is 1 cm. Distinguished from No. 10 by being smaller and found in shallow water. Arms regularly banded. Sexually immature when examined in June and July.

V. *Ophiothrix*, Müll and Trosch.

Disk set with thorny grains and spines set with thorns either at the top or on the sides; radial shields are large triangular swellings; numerous tooth papillae, but no mouth papillae; arm spines longer than the joints, 5–10 in number, flattened and glassy, having a central shaft; interbrachial spaces swelled out like lobes, each of which has two genital openings beginning outside the mouth shields.

12. *Ophiothrix Oerstedii*, Ltk. 213–226. 153–156. Disk 1.2 cm. in diameter. Bulging between the arms. Deep green in color, but opposite each arm is a yellow line, bordered on each side by two black lines, reaching almost to the center of the disk. The arms and disk are covered with long spines. Two specimens dredged from East Harbor and one taken from under stones on Fort Reef. The most common species at Port Henderson.

VI. *Amphiura*, Fbs.

Disk small and delicate, covered with naked overlapping scales; radial shields uncovered; no tooth papillae and few mouth papillae; arms long and slender; spines short and regular; two genital openings in each interbrachial space.

13. *Amphiura Palmerii*, Lyman. 123–143. Diameter of the disk, 9 cm. Arms very long and spiny. Light yellow in color. Upper side of disk covered with short spines, except in five naked areas opposite the bases of the arms, where the radial shields are exposed. Three specimens dredged off Folly Point and East Harbor.

VII. ————.

14. ——, ——. Two specimens of an Ophiuran were taken with the dredge from East Harbor which were of a light green color and with a disk diameter of .6 cm.; six arms, which were short and furnished with very short, blunt spines or knobs. No plates could be made out except about the mouth.

The Development of Pilularia globulifera L.

By Duncan S. Johnson.

(Abstract of a paper published in the *Botanical Gazette*, July, 1898.)

The following abstract gives some of the results gained from a study of the development of the leaf and sporocarp in Pilularia, which has been carried on by the writer in the biological laboratory of this university, while holding the Adam T. Bruce Fellowship for the year 1897–98.

The leaf of Pilularia, like that of Marsilia and many other leptosporangiate Ferns, develops from a two-sided apical cell. The number of primary divisions in each segment of the eleven or more pairs formed from this is four, instead of six as in Marsilia. All of these divisions take part in the formation of each of the three meristem layers. An epidermis and a hypodermis, each of a single layer, are developed from the protoderm, and in the former of these are developed stomata and trichomes. From the ground-meristem are formed the single layer of mesophyll and the partitions separating the ten air canals of the leaf. The procambium gives rise to the vascular bundle together with its sheath, which therefore does not come from the surrounding ground-meristem as usual. No indication of any rudiment of a lamina was discovered by a careful study of the mode of division of the segments at the tip of the leaf.

The sporocarp arises by the formation of a two-sided apical cell in one of the anterior marginal cells of the leaf near its base. Six or more segments are cut off from each side of this, which have seven primary divisions formed in each, exactly as in Marsilia. In the segments forming the stalk of the sporocarp, which do not always form seven primary divisions, the formation of tissues from the three meristem layers is similar to that in the leaf, except that the ventral part of the procambium gives rise to a bundle of sclerenchyma tissue.

In the terminal segments of the sporocarp, forming the capsule, two of the ultimate marginal cells on each side one for each sorus, are devoted to the formation of sporangia. These sporangial marginal cells divide, in a more irregular manner than in Marsilia, to form the sporangium-mother cells, and these are in the meantime overgrown and enclosed in the soral canals by the other cells of the ventral side of the capsule. The sori are thus in a right and a left pair and are lateral in position at first, none being terminal as described by Meunier and Campbell. Later on, by the more rapid growth at the base of the capsule on the ventral side, the openings of the soral canals are pushed around to a nearly terminal position.

The macrosporangia and microsporangia are not derived from different marginal cells as in Marsilia, but the two are indistinguishable up to the time of the formation of the spore-mothercells.

The axial vascular bundle, entering the capsule at the base, gives off soon a branch toward the left and another toward the right, each of which furnishes the six branches of the two valves on its side of the capsule, together with the placental bundle and placental branch arising from the middle bundle of each valve. The three main bundles of each sorus fuse together against tip of the valve, but there is no fusion of bundles from different sori as in Marsilia.

The firm wall of the capsule of Pilularia consists of an epidermis of thick brown walled cells, an outer hypodermis of thick clear walled prismatic cells and an inner hypodermis of more irregular brown walled cells. Across the base of the capsule is formed the basal wall, one layer of which is exactly like the outer hypodermis and continuous with it, having the same characteristic "light line." Near the dorsal side of the capsule there is a slit through this wall, corresponding to the air passage opening into the lens-shaped space of Marsilia, but the loose tissue near this slit in Pilularia is not cut off from the rest of the capsule. A projection, corresponding to the lower tooth of the capsule of Marsilia, is present in Pilularia and a depression or pit is formed just above this, but no upper tooth is present.

The outgrowth of the cells of the ventral side of the capsule gives rise not only to the wall surrounding all the sori, but also to the indusium which separates the individual sori from each other. The mode of development of this tissue seems to warrant calling it an indusium, as was held by Mennier.

Of course the whole question of homology is here greatly complicated by the fact that the Marsiliaceae seem to bear the sporangia on the upper side of the leaf. But the transition from a form like Lygodium, with single sporangia developed from marginal cells of the leaf, to the present forms where the marginal cell may give rise to several sporangia does not seem perhaps so very abrupt.

The capsule of Pilularia then is essentially a Marsilia capsule with only two pairs of sori, and both are to be considered as branches of the leaf in which, instead of forming a lamina, the marginal cells have been devoted to the formation of sporangia. Of the two genera, the evidence at hand indicates that Marsilia is more nearly related to the other Leptosporangiatae.

Dr. F. S. Conant's Notes on the Physiology of the Medusae.

By E. W. BERGER.

While in Jamaica with the Johns Hopkins Marine Laboratory, during the summers of 1896 and 1897, Dr. Conant preserved material and made many observations and experiments upon the medusae. His systematic, morphological and histological results have since been published as his thesis by the University, while his notes on the physiology, together with other results from the material preserved by him, remain.

It is intended in the following paragraphs to note briefly only the results obtained and to leave the notes themselves, together with a fuller discussion, for a more complete paper. Since, however, the notes were left almost wholly undigested, some attempts at generalization will here and there be made.

The forms used in these observations were Charybdea Xaymacana, one of the two species first found and described by Dr. Conant, Aurelia aurita and Polyclonia. The greater number of these notes are on Charybdea and were left just as taken at the time of experimenting. Many of these notes are highly interesting and in the main fit in well with Romanes' results.

It was at the request of Dr. Brooks, soon after the unfortunate death of Dr. Conant, that the present writer has undertaken to make use of his notes and other medusan material.

For the anatomy of Charybdea see the November (1897) number of the *Johns Hopkins University Circulars* or Dr. Conant's thesis, "The Cubomedusae," both published by the Johns Hopkins Press.

Light.

A part of Dr. Conant's experiments were performed in a photographic dark room with the animals in a deep glass aquarium jar. In the dark a fair proportion of the animals became nearly quiescent on the bottom, but upon lighting a lamp many started up immediately, while others took a longer time to come to the surface and swim. Such experiments were tried a number of times and on different occasions with very similar results. Some, however, tried immediately after being brought in, seemed not to react so well upon being placed in the dark room, nor would they become quiescent. This probably was due to the fact that the animals had not yet recovered from the effects of being caught and placed in new surroundings.

Other experiments were tried by carrying the jar with the animals from the weaker light of a room into the more intense light of outdoors or into direct sunlight. The usual result was an inhibition of pulsation and a settling to the bottom, while they immediately became active again upon returning with them to the room. These results were so marked that no doubt can be entertained as to their cause, though some exceptions occurred in which animals placed in the sun continued to swim on the surface or soon recovered pulsation. In some experiments, too, no animals responded to the stimulus of the brighter light or all very soon recovered.

Reducing the light by placing a coat over the jar produced the same effect in some experiments as reducing the light in other ways, while removing the coat produced the same effect as exposure to brighter light. It is, of course, to be noted, too, that when left for some time in any one place the animals changed, some coming to the surface and others going to the bottom.

Such experiments as indicated above show beyond doubt that Charybdea is sensitive to light and that it is moderate light which stimulates the animals to activity, while darkness and strong light inhibit such activity. While the individual exceptions, as Conant himself suggests, are well explained on the supposition of individual differences, yet it appears that other conditions, such as the time of day, temperature, etc., may have been responsible for the exceptional experiments in which no animals responded as expected.

Also, what may have been appreciable light to one animal was less such to another or quite strong light to a third.

While light of any intensity seems to have stimulated Romanes' Sarsia and Tiaropsis to activity, we note that it is moderate light which stimulates Charybdea. This is evidently correlated with the fact that Charybdea is chiefly a bottom-living form.

Were one to conclude from the behavior of Charybdea in light and darkness in the laboratory that it remained on the bottom in the day-time, but became more active near the surface evenings and early mornings, one would probably not be far from the truth. Dr. Conant in towing near the bottom with a weighted net, in water four to five feet deep not far from shore and deeper farther out, found Charybdea in abundance mornings and afternoons, but very few in the evening. In the evening some were usually taken in the surface tow.

Finally, while I find no experimental evidence in Dr. Conant's notes about what parts of Charybdea are sensitive to light, it would seem preposterous, from histological evidence, to doubt that the eyes of the four marginal bodies are the seat of this stimulation.

Dr. Conant further experimented by cutting off certain organs or parts from the Cubomedusan bell. These excisions consisted chiefly in cutting out the concretions of the sensory clubs, cutting off the whole club, eliminating a part or whole of the margin or velarium, cutting the bell in sectors, excising the stomach, and parts connected with it, and other parts. The remainder of this paper will be given to briefly stating the results of these operations.

Concretions.

The four concretions were removed from each of four animals. Two of these (1 and 2) seemed to be little if at all effected by the operation. One (1) swam actively, at first up and down more changeably than those intact, but later mostly near the surface. The other one (2) also swam actively and showed nothing to indicate weakened sense-perception. The other two (3 and 4) did not stand the operation well, as Conant states, and immediately went to the bottom where they remained, one swimming, while eight hours later one was still in good condition.

Several attempts with stronger light by removing the coat from the jar made no difference in the behavior of 1; it continued to swim as heretofore. Upon a final trial, however, with removing the coat, it went to the bottom, thus showing a sensibility to light; but when next seen it was keeping to the bottom.

We can hardly suppose that the concretions function as organs of light sensation as the first of the above animals would seem to indicate, for the animal evidently later reacted normally to light. The fact, too, that this same animal (1), together with another (2), swam actively, immediately changing their course upon coming to the surface, in reality behaving quite as normal animals, hardly permits us to conclude from the behavior of 3 and 4 that the concretions function directly as organs of equilibrium or space relations. Might not these concretions function simply as weights for keeping the sensory clubs with their eyes properly suspended? Since these concretions lie at the lowermost part of the clubs and in closed sacs and unsupported by cilia, it would seem that the above suggestion as to their being weights is not so improbable. Direct observation by Conant shows, furthermore, that the clubs always hang with a tendency for the concretions to be lowermost regardless of the position of the animal.

Sensory Clubs.

The entire sensory clubs were removed from a number of animals. A paralysis of pulsation followed by a rapid recovery was the usual result. In some instances, however, there was no paralysis while in others no recovery followed paralysis. This applies in a general way whether one club only or all were removed. Pieces of tissue with a club attached and pulsating regularly (See also Polyclonia) ceased pulsating after removal of the club, in one instance, however, still giving occasional contractions.

The paralysis following the removal of the clubs is evidently the effect of nervous shock, and points to the existence of some definite nervous mechanism in the clubs. The histological evidence is here, as usually, corroborative of the physiological.

While these results are the same in regard to shock as were obtained by Romanes upon Aurelia aurita after removing the lithocysts, they differ from his in the apparently complete recovery of pulsation. It may be added, too, that Conant succeeded in obtaining coördinated contractions on an Aurelia, found about Jamaica, after removal of all the lithocysts. (See Aurelia.)

Another interesting phenomenon observed after the removal of one or all of the sensory clubs was the strange behavior of the proboscis. This would reach from side to side expanding and contracting its lips as if trying to grasp something. This behavior is very similar to that of the proboscis of Tiaropsis indicans when Romanes stimulated any part of its subumbrella.

Velarium and Frenula.

"The power of originating contractions," to use Conant's own words, "evidently resides in the velarium or in ganglion cells of the frenula, just as it does in the proboscis and floor of the stomach." Isolated pieces of the velarium contracted by themselves as did the whole velarium when all other tissue had been removed. An isolated velarium with the margin and the pedalia attached gave irregular contractions. When the pedalia with the *interradial ganglia* were removed it still continued to contract; and when all the other tissue was cut off contractions still continued.

Cutting the velarium caused the *pedalia* to be strongly contracted inwards so that the tentacles were brought inside the bell. Cutting away the velarium did not interfere with the pulsations of the bell, but progress was much retarded.

Cutting the frenula caused the *pedalia* to contract but seemed not to effect the ability to swim.

Stomach, Suspensoria, Proboscis, Subumbrella.

The proboscis and the stomach with the phacelli when cut out contracted with or without the lips removed. The isolated lips also contracted (twitched).

Pieces of the sides connected only with the stomach and suspensoria or with the *margin* contracted (twitched) spontaneously, but seldom did so when these were removed. In one instance the whole side was cut out so as to exclude the radial ganglion, but still connected with a portion of the suspensorium. (See Velarium.) This pulsated, or contracted, but on being halved transversely the lower half ceased to contract while the upper half connected with the suspensorium continued to contract.

Cutting off the whole stomach end of the animal excited to very rapid pulsations of the remaining part with the stream of water stronger out the aboral end than past the velarium.

Dr. Conant says, "It seems I get no good evidence of the subumbrella without connection with any special nerve centres being able to contract by itself." The piece in which he did get contractions he suspects may have been intimately associated with some part of the frenula or the suspensoria. In Polyclonia no such doubt exists for small pieces of subumbrella were seen to contract. (See Polyclonia.) A small piece of subumbrella connected with a sensory club could contract by itself.

Margin, Radial Ganglia, Nerve.

Complete removal of the margin did not stop pulsation; but the removal of the radial ganglia stopped it permanently. While this experiment seems to have been tried only once, yet taking into consideration the results of other operations, it seems that the principal centres of spontaneity reside in these radial ganglia. (See also *margin* under stomach.)

In a Polyclonia paralysis of pulsation followed the removal of the margin but spontaneous contractions were observed some time after, showing a partial recovery. (See Polyclonia.)

Cutting the nerve in the eight adradii caused the *pedalia* to bend inwards at right angles to their normal position but did not in the least affect the coördination of the sides. When, however, the sides were cut in the eight adradii to the base of the stomach, coördination ceased and each side pulsated in its own rhythm.

Pedalia, Interradial Ganglia, Tentacles.

When the pedalia were removed the power of the animal to guide itself was completely gone. When one pedalium was cut the others contracted, while stroking the outer edge of the pedalia, touching the sensory clubs or sharply pricking the subumbrella, often produced the same result. (See Nerve.)

When the pedalia were cut off far enough up to remove the interradial ganglia coördination was not effected and the animal could pulsate well enough but with little progress. (See also Velarium, Frenula.)

An isolated tentacle is capable of squirming contractions and when stimulated at either end it would contract wholly or in part only.

Temperature.

Ice in the water seemed to have no effect except when held against the animal when a slowing of pulsation followed in a few instances. On some pulsating actively in the sun the temperature of the water was found to be 92° F.

Aurelia and Polyclonia.

Many of the observations on these forms relate to the rate of pulsation. In an Aurelia, following the removal of a lithocyst, there was a pause followed by pulsations. In about two minutes rythmic pulsations were resumed. Four minutes after the operation there were nineteen pulsations to the half minute, while twenty minutes after there were only nine, and

groups of six and three. The normal rate of pulsation was twenty-
ne half minute.
onia behaved much in the same manner as Aurelia. Upon the
of a lithocyst pulsations continued but in groups with short pauses.
mal rate of pulsation was twenty-seven to the half minute, while
inutes after the operation it was seventeen, and eleven minutes
een to the half minute. The tissue connected with a removed
gave contractions.
emoval of a single oral arm or of the whole eight in Polyclonia
h the same effect as the removal of a lithocyst: there was a decided
of the rate of pulsation, while, however, the immediate effect was
eration or a return to the normal rate. About a day later this
mal had quite regained its normal rate of pulsation and continued
r several weeks.
eady noted under *Sensory Clubs*, an Aurelia with all its lithocysts
still gave spontaneous and coördinated contractions after allowing
recovery from the operation. This was the result in one instance
several others only a few contractions were observed. Removal
xteen marginal bodies in a Polyclonia produced paralysis for a
it soon recovery followed.
yclonia with its entire margin removed was paralyzed, but had so
vered in a day as to be able at intervals to give spontaneous
s.
moved margin of a Polyclonia pulsated vigorously. This margin
split so as to make a ring within a ring but connected at one point
ll bridge of tissue. The waves of contraction, which always origi-
the ring with the lithocysts, passed the bridge to the inner ring
e same as Romanes experienced. The outer ring was next split so
arate the exumbral portion from the subumbral, when it was found
contractions always originated from the latter.
days after its removal this same margin was still alive and pulsa-
rously, and broken off pieces of the *subumbral* portion were pulsating
elves. Fifteen of the ganglia were removed. It was then found
ile most of the pulsations originated at the remaining ganglion, now
contractions originated in other parts where no ganglion remained.
s later this margin was still alive with contractions originating as
m other parts as from the ganglion.
ith the eight lithocysts of one side removed, to compare with a
ne, gave no evidence of affected coördination.
l lobe from an Aurelia could give contractions some minutes after

ther Aurelia a circular cut was made about the base of the oral
ough the epithelium of the subumbrella. The animal could pul-
enough but coördination seemed a little affected, while in another
a like cut, but semicircular, no effect was noticed.

t is at present undetermined whether Conant had Polyclonia or Cassiopoea, or
ork with. Since he mentions removing sixteen marginal bodies, it would seem
d Cassiopoea; however, some specimens brought from Port Antonio, Jamaica,
twelve marginal bodies and twenty-four radial canals, which is characteristic
; to Haeckel) of Polyclonia. At all events, Conant speaks of them as Poly-
is notes of 1896, and as Cassiopoea in 1897.

es on the Tentacles of Nautilus pompilius. By
NCE E. GRIFFIN.

aluable material upon which these notes are based was presented
epartment of Animal Biology of the University of Minnesota by
is Menage, and I am greatly indebted to Professor Nachtrieb for
t at my disposal.]

llowing notes on the structure and homologies of the tentacles of
describe points which have been of great interest to me and which
portant enough to justify publication preliminary to a complete
f the anatomy of the Nautilus.
e tentacles of the Nautilus are built after a single plan, and pre-
essential features of this even when highly modified. Ordinarily
cle is considered to be formed by two parts—a fleshy sheath sur-
an extensile cirrus. The cirrus is the essential structure and will
n of as *the tentacle*, while the sheath seems to be merely a fold of
which has been produced around the cirrus for protective or supportive purposes. Surrounding the head of the Nautilus are thirty-eight tentacles to which Owen gave the name of *digital tentacles*. The sheaths of these are fused to each other so that a complete *Cephalic Sheath* (Owen), open ventrally only, is formed. These tentacles have been described as having no regular arrangement, but an examination of fifty-one specimens proved that they are arranged upon each side in a constant order. Only six specimens showed a variation from the normal arrangement, and this variation existed in each case upon one side only. Whether the same tentacle always occupies the same position or not cannot be decided till after further dissection of the nerves going to the tentacles.

The digital tentacles present the structural plan uniformly and simply. The surface of the tentacle is marked by a close series of annular grooves, which are deepest upon the inner side of the tentacle. The tentacles are frequently flattened upon the inner side. A large nerve trunk occupies the center of the tentacle; around this are the radial bundles of longitudinal muscles. Closer examination of the nerve cord reveals that it is enlarged by collections of ganglion cells at regular intervals, each enlargement corresponding in position to a segment of the tentacle included between two of the annular grooves. From the ganglionic enlargements nerves pass to the different portions of the segment, but especially to the inner side. The segmental structure of the nerve cord persists in cases where all traces of the external annulations have disappeared.

Dr. Willey in a recent article, described the great adhesive power of the digital tenacles. This power seemed strange until after a closer study of the segments of the tenacles. The groove between the segments is much deeper upon the inner face of the tentacles than elsewhere. The inner face of the segment is flattened. On this side, between the epithelium and the longitudinal muscles, are radial transverse muscles; the only transverse muscles in the tentacles which we can surely identify as such.

Their operation would be somewhat as follows—when the flat surfaces of the segments of the tentacles are applied to any body a contraction of the radial muscles within each segment would pull the central portion away from the opposed surface and cause a vacuum to be formed between the segment and the surface. The adhesive power of any one segment must be slight; but there are from sixty to one hundred segments in each tentacle, half of which would probably be in a position to hold. And there are thirty-eight tentacles in the group. Thus the combined adhesive power of all the segments is very great.

It seems to me probable that we see here the beginnings of the suckers of the Dibranchiates. As these Cephalopods became more active and predatory, the simple sucker would naturally have been modified to form an organ better adapted to quick and sure seizing of the prey. Yet the principle of action is the same in the Nautilus and the Dibranchiates. It seems probable that the projecting portion of each segment of the tentacle formed a single sucker. Growth would cause these to take alternating positions. Possibly from each segment several suckers were formed by subdivision of the adhesive surface and the development of each portion into a sucker. These may have remained arranged in transverse rows, as in Sepia and other forms.

This theory of the formation of the suckers of the Dibranchiates necessitates our regarding the arms of the Dibranchiates as each corresponding to a single tentacle of the Nautilus, and not to groups of tentacles. The structure, arrangement and relations of the arms support the first view far more than the second. Comparison with the processes of change in other orders weakens the latter theory while strengthening the theory that a few tentacles gradually increased in size while the remainder were crowded aside and reduced.

The *ocular tentacles* present several differences of structure from the digital tentacles. Their sensitiveness is much greater. The greater depth of the annular grooves on the inner side is immediately noticed. Willey has found that the sides of the groove are ciliated. In some instances I find the cilia extending over the surface between the grooves.

Of internal structure, two points are especially remarkable. One is struck by the ease with which the tips of the ocular tentacles break off. This seems to be the result of a peculiar arrangement. In the plane of the annular groove the adjoining segments are separated by what in sections appears as a plain line along which the tissues are evidently weaker than elsewhere. In apparently normal cases there is no separation of the tissues, but the weak line appears sharply and distinctly. The line does not extend through the epidermis or the nerve cord. The lines are only found in the upper portions of the tentacles. It is difficult to understand of what use this arrangement can be. The tips of the tentacles break off with exceeding ease, but can this be in any way advantageous to the Nautilus?

The other point is regarding the structure of the nerve trunk. There is here what I have termed an *accessory nerve trunk*. The usual nerve trunk is present having its layer of ganglionic cells around its periphery and its ganglionic enlargements in each segment of the tentacle. On the inner side of this, through nearly the entire length of the tentacle, runs a large nerve trunk, composed of several bundles of nerve fibres. The main nerve trunk and the accessory are closely united, but are easily distinguished by the layer of ganglion cells which surrounds the main trunk. There are very few, if any, ganglion cells in the accessory trunk. At the ends of the tentacle the accessory trunk gradually disappears; at the upper end by giving off nerves, chiefly to the inner side of the tentacle; at the base of the tentacle by gradual union with the main nerve trunk.

This accessory trunk has apparently been developed in connection with the remarkable sensitiveness of the ocular tentacles.

The nerves of the two ocular tentacles of each side are branches of a nerve which comes off from the pedal ganglion near the outer end, which also sends branches to the Hood.

The Hood consists of the fused and enormously enlarged sheaths of the dorsal digital tentacle of each side. The origin of the nerves of the ocular tentacles in the pedal ganglia and the fact that they form portions of nerves going to the sheaths of digital tentacles proves, as Dr. Willey has suggested, that the ocular tentacles cannot be considered as other than somewhat modified (and perhaps displaced) digital tentacles, and that they can in no wise be considered as the homologues of the optic tentacles and rhinophores of Gastropods.

There is in the female Nautilus, ventral to the buccal mass, a fleshy lobe which, dividing into two near its tip, bears upon each half ten to fourteen tentacles and, at the point of division, a rounded organ composed of a number of triangular lamellae. This lobe (the inferior labial lobe of Owen) is wanting in the male Nautilus; instead is found, nearly hidden beneath the buccal mass, a rounded organ which is named from its discoverer *Van der Hoeven's organ*. I think that anatomical evidence is strong enough to convince us that the inferior labial lobe and Van der Hoeven's organ are homologous organs.

There are about sixteen lamellae in the group in the center of the inferior labial lobe. The group is separated at the median line into two halves, the lamellae of each side facing each other. The largest lamellae are at the centre of the group, the smallest at the exterior. The lamellae are marked upon both surfaces by grooves parallel to their bases. A nerve showing some traces of ganglionic enlargements runs to the tip of each lamellae. The nerves of the lamellae of each half of the group unite. The trunk thus formed unites with the nerves of the tentacles of the lobe of its own side and the common trunk enters the pedal ganglion near the median line. The tentacles of each lobe are largest near the outer end of the series. They grow smaller and smaller as the median line is approached; those nearest the median line are frequently so small as to be scarcely visible. At this point it is possible to find a complete series of gradations between the lamellae of the median organ and the tentacles. The structure of the lamellae confirms the suspicion that they are modified tentacles. This homology has been suggested by Van der Hoeven.

Between the bases of each two lamellae is a pit lined by exceedingly slender epithelial cells. These cells are also from two to three times the height of ordinary epithelial cells. The cells bear cilia; apparently each cell bearing a single cilium, but the preservation of my material is not good enough for me to make sure of this point. Fine fibres appear to run from the bases of the cells into the tissues.

As has been said, Van der Hoeven's organ occupies the same place in the male that the inferior labial lobe occupies in the female. This organ is about one inch in length, three-quarters of an inch in breadth, and two-fifths of an inch in thickness. It is enveloped by a tunic which, over the anterior dorsal half, is free from the organ; thus allowing free communication between the interior of the organ and the exterior. The anterior half of the organ is separated into halves by a narrow vertical slit which leads into the central cavity. This is a low horizontal cavity extending from side to side. [illegible] the anterior end, on each side of the opening, are a number of low, [illegible]ical lamellae which quickly pass into thin, broad, shelf-like, hori- [illegible]llae which extend as far back as the posterior limit of the verti- [illegible]pening of the organ. Back of this point the organ is glandular; the glands completely surround the central cavity. The glands are typical examples of the compound-tubular type. The epithelial cells of both glands and lamellae are tall and cylindrical. The cells of the lamellae are for the most part heavily loaded with secretory products. The cells of the glands are also loaded. Yet the lumens of the glands as well as the central cavity are entirely free from secretion, this evidently being stored in the cells till needed for some unusual purpose.

Another kind of cell is found among the epithelial cells of both glands and lamellae. Around each epithelial cell are several fine hair-like sensory cells. The middle of each is swollen by the elongated oval nucleus. The tip of each cell is produced into a stiff sensory hair. The immense number of these cells bearing hairs makes the surface appear densely ciliated. The ordinary epithelial cells are of so much greater bulk than the sensory cells that close examination is required to reveal the fact that the cilia do not belong to them. I have seen the bases of the sensory cells continued for some distance into the sub-mucous tissue as fine fibres, of about the same diameter as the cell.

The nerves which innervate Van der Hoeven's organ have the same place of origin as those which innervate the inferior labial lobes of the female. One nerve enters each side of Van der Hoeven's organ and divides into a large number of branches. One of these runs into each lamella and several supply the glandular portion of the organ.

The number of lamellae of Van der Hoeven's organ closely corresponds to the number of tentacles plus lamellae of the inferior labial lobe. The innervation is the same in each, except that the nerve seems to form all its branches at one point in Van der Hoeven's organ instead of at two points as in the labial lobe. The musculature of the one is the same as of the other. Willey finds that the same arteries supply both organs, and upon this fact bases the suggestion that they may be homologous. The sensory cells of Van der Hoeven's organ evidently correspond to those found between the bases of the lamellae on the labial lobe. Only, in the one case they are restricted to definite areas while in the other they are scattered throughout the organ. In short, anatomical evidence admits of no conclusion but that Van der Hoeven's organ of the male Nautilus is strictly homologous with the inferior labial lobe of the female Nautilus.

From the fact that the glandular cells in my sections of Van der Hoeven's organ are nearly all heavily loaded and that absolutely no secretion is present in the lumens of the glands or in the central cavity of the organ, it appears that its glandular function may be limited to certain times and conditions, possibly connected with reproductive processes. The sensory function is probably the same in both sexes, and continually active. Though it is possible that this also may be closely connected with reproduction.

The structure of the Hectocotylus (or Spadix) has recently been admirably described by Vayssière. Still, there are several points which may be added to his description.

The Hectocotylus is composed of a group of four tentacles. These become highly modified. The organ is usually situated upon the left side; but in between twenty and twenty-five per cent. of my specimens it is upon the right side. In one case Hectocotyli are upon both sides. On the opposite side of the animal from the Hectocotylus is a similar group of four tentacles, but unmodified.

Three of the tentacles forming the Hectocotylus are closely enveloped by a fleshy sheath; the fourth and smallest only partly. On the external side of the sheath, at the margin, is a circular glandular area. The glands are compound-tubular, branched quite simply. They extend, in a direction perpendicular to the surface, about three-quarters of the distance through the sheath. Upon examining the corresponding portion of the sheath of the similar group of the opposite side I found a glandular area in the same position as that upon the sheath of the Hectocotylus. The area is smaller, the glands are less developed, yet are exactly similar in structure. The presence of this gland on both groups of tentacles is extremely interesting, as it *may* indicate an original hectocotylization of both groups.

In the second tentacle of the Hectocotylus (the tenth cirrus of Vayssière) is another interesting series of glands. This tentacle is annulated, the grooves being deepest upon the upper side. Into each groove, upon this side, opens a row of perfectly simple sac-like glands. The openings are exceedingly small and are well hidden in the depths of the grooves. A single layer of columnar epithelial cells lines the gland. The cells of the neck of the gland are low, but they rapidly increase in height as they pass into the gland, so that the body of the gland is lined by exceedingly high cylindrical cells.

under the direction of a Board of Control nominated by the heads of the institutions above mentioned and commissioned by the Governor.

During the first five years of the existence of the Service the investigations were confined largely to a study of the general meteorological conditions of the State. Numerous stations were established in the different counties, volunteer observers having been obtained at a sufficient number of points to render it possible to determine the more important features of the climate of the State. Throughout the same time monthly Meteorological Reports, extending through the year, and weekly Crop Bulletins, covering the growing and harvesting seasons, were published. Two biennial reports to the General Assemblies of 1894 and 1896 were also prepared and subsequently printed with the necessary maps, diagrams, and tables. A series of large Climatic Charts was also published and placed on exhibition in the Maryland Building in Chicago at the time of the Columbian Exposition, and copies of the same were subsequently distributed.

Somewhat over a year ago an entire reorganization of the work of the Maryland Weather Service was effected. It seemed desirable to transfer the accumulation of the general climatic data to the Climate and Crop Service of the Weather Bureau, which is much more fully equipped for carrying on that phase of the work, and to devote the money and energies of the Maryland Weather Service to the study of special problems connected with the climatology of the State. It was thought possible by conducting the work in close coöperation with the State Geological Survey, the State Agricultural institutions, and the U. S. Department of Agriculture to take up lines of research that would be of much permanent value to the people of the State. Arrangements were made for the publication of these investigations in a new series of reports which should conform in all particulars to those already adopted for the State Geological Survey. These volumes, for which arrangements have now been perfected, will contain the results of investigations upon the climate of the State and will include reports upon the physiography, meteorology, medical climatology, agricultural soils, forestry, hydrography, crop conditions, botany, and zoology of Maryland.

The reports upon physiography and meteorology are already largely prepared and will constitute the first volume of the series. Dr. Cleveland Abbe, Jr. has prepared a report upon the physiography while the longer and more elaborate statement regarding the meteorology of the State is divided into three parts, the general treatment of the subject being from the pen of the distinguished Professor Cleveland Abbe of the U. S. Weather Bureau; Mr. F. J. Walz the Local Forecast Official of the U. S. Weather Bureau in Baltimore and the Meteorologist of the State Weather Service will contribute the part relating to the meteorology of the State; while Mr. O. L. Fassig, his associate, will prepare those chapters which relate to the history of meteorological investigations in Maryland since early colonial days. The cordial support of Professor Willis L. Moore, Chief of the U. S. Weather Bureau, has been secured in this work as well as in many of the lines of special investigations which will be later pursued.

The investigations of the agricultural soils of the State, already referred to in connection with the State Geological Survey, are closely related to many of the climatological problems which will be considered in the future, and the active coöperation of Professor Whitney along these lines will add much to the effectiveness of the State work. Mr. C. W. Dorsey of the State Agricultural Experiment Station has been carrying on investigations in this field under the supervision of Professor Whitney and the results of their combined work will be later brought out in the reports of the State Weather Service.

The questions of hydrography are closely related to those of climatology and already considerable progress has been made in the study of the drainage basins of Maryland through the co-operation secured from Professor Newell in charge of the Division of Hydrography of the U. S. Geological Survey and special reports upon this subject will be incorporated in a later volume of the State Weather Service.

The other lines of investigations above referred to have been projected, but little work has been done upon them thus far. They will occupy the attention of the local Service during the coming and subsequent years.

Wm. Bullock Clark,
State Geologist and Director State Weather Service.

The First Geological Excursion along the Chesapeake in 1608. By Edward B. Mathews.

The first expedition for the purpose of investigating the natural resources of the territory now embraced in Maryland and Virginia was made during the summer of 1608 by Captain John Smith and his companions. Although the results are of little or no scientific value when judged by present standards, the circumstances under which the work was carried on become of interest in connection with the extensive studies which are now being prosecuted by the Maryland Geological Survey. It has long been known that incidental references to minerals were made in Smith's writings but no hint has ever been given indicating the official character of the study.

In the "instructions by way of advice, for the intended Voyage to Virginia," published in 1606, certain duties were imposed upon the captains of the companies going out to the colony. When they reached Virginia they were "to find out a safe port in the entrance of some navigable river making the choice of such a one as runneth farthest into the land, and .... that which bendeth most toward the Northwest for that way you shall soonest find the other sea." When they had chosen a river they were to select a place "so far up as a bark of 50 tuns will float" and there to establish their settlement. When they had determined upon their location and landed supplies the six score men of the company were to be divided into three parties according to the following suggestion, "one party of them you may appoint to fortifie and build, of which you first work must be your storehouse for victuals; the other[s] you may imploy in preparing your ground and sowing your corn and roots; the other ten of these forty you must leave as centinel at the haven's mouth. The other forty you may imploy for two months in discovery of the river above you, and on the country about you; which charge Captain *Newport* and Captain *Gosnold* may undertake of these forty discoverers. When they do espie any high lands of hills, Captain *Gosnold* may take twenty of the company to cross over the lands, and carrying a half dozen pickaxes to try if they can find any minerals." They were further instructed to observe whether the river on which they planted sprung out of mountains or out of lakes. "If it be out of any lake the passage to the other sea would be more easy, and [it] is like enough, that out of the same lake you shall find some spring which run[s] the contrary way toward the East India sea." They were likewise requested to furnish a "perfect relation" of all that was done, indicating where they were located, what commodities they found and the character of the soil and woods.

From the foregoing instructions it is evident that the London Virginia Company desired their officers to make as complete a reconnaissance of the area as possible. Captains Newport and Gosnold, although especially instructed to carry out the exploratory work of the colony apparently did not visit the present territory of Maryland, and it was not until 1608, when Captain John Smith made his voyage of discovery up the Chesapeake Bay, that this particular area was explored. In a letter written by him to the "Treasurer and Councell" of Virginia in 1608, Smith gives the following summary of his surveying both topographical and mineralogical:

"Now that you know, I haue made as great a discovery as he [Newport], for lesse charge than he spendeth you every meale: I haue sent you this Mappe of the Bay and Rivers, with an annexed Relation of the Countries and Nations that inhabit them, as you may see at large. Also two barrels of stones, and such as I take to be good Iron ore at the least; so devided, as by their notes you may see in what place I found them."

No other reference is given in Smith's works to this collection of specimens, and it is probable that they were soon lost sight of when they proved of little value.

During his exploration of the Potomac he learned from the savages of the presence of a peculiar mine some distance up the Quiyough [Aquia] Creek, and decided to visit it, although it involved a march of seven or eight miles from his boat. He gives the following description of the place: "The mine is a great Rocky mountaine like *Antimony;* wherein they digged a great hole with shells and hatchets: and hard by it, runneth a fayre brooke of *Christal*-like water, where they wash away the drosse and keepe the remainder, which they put in little baggs and sell it all ouer the country to paint theire bodyes, faces, or Idols; which makes them look like Blackmoores dusted all over with siluer. With so much as we could

re returned to our bo[a]te, kindly requiting this kinde king and all
de people.

e cause of this discovery was to search [for] this mine, of which
t did assure vs that those small baggs (we had giuen him), in *England*
tryed to hold halfe siluer; but all we got proued of no value:"

ough Smith spent scarcely a month in his exploration of the entire
ry on either side of Chesapeake Bay and its upper tributaries, he
depicts on his well-known map of Virginia a difference in topography
n the Coastal Plain and the Piedmont Plateau, representing the
without hills, except along the Calvert Cliffs, and the latter with
ous elevations. The line of demarkation as delineated corresponds
closely with that recognized at the present time. It is described as
:

om the head of the Bay to the Northwest, the land is mountanous,
in a manner from thence by a Southwest line; so that the more
rard, the farther off from the Bay are those mountaines. From which
rtaine brookes which after come to the fiue principall navigable
These run from the Northwest into the Southeast, and so into the
ide of the Bay, where the fall of every River within 20 or 15 myles
another."

itional facts are given regarding the topography and soil of the State
ws: "The mountaines are of divers natures: for at the head of the
e rockes are of a composition like Mill stones. Some of Marble, &c.
any peeces like Christall we found, as throwne downe by water from
nountaines. For in Winter they are covered with much snow, and
it dissolveth the waters fall with such violence, that it causeth great
tions in some narrow valleys, which is scarce perceived being once in
ers. These waters wash from the rocks such glitering tinctures, that
ound in some places seemeth as guilded, where both the rocks and
rth are so splendent to behold, *that better judgements than ours might
en perswaded, they contained more than probabilities.* The vesture of
rth in most places doth manifestly proue the nature of the soyle to
y and very rich. The colour of the earth we found in diverse places,
leth *bole Armoniac, terra sigillata ad Lemnia*, Fullers earth, Marle,
vers other such appearances. But generally for the most part it is
ke sandy mould, in some places a fat slimy clay, in other places a
arren gravell. But the best ground in knowne by the vesture it
, as by the greatnesse of trees, or abundance of weedes, &c."

map also indicates an attempt to represent the differences in the
ter of the forest trees growing in different portions of the region
ed. The foregoing facts, accordingly, clearly indicate that efforts
ade to acquire information regarding the physical features, including
nerals, soils, topography, drainage, and vegetation of the territory
the Chesapeake. The actual amount of information gained, con-
g the time alloted, compares favorably with that of any contempo-
s explorations along the borders of the American continent, and is
t much below many of the exploring expeditions sent into the heart
ica during the last few decades.

ro Excursions with Geological Students into the tal Plain of Maryland.

By GEORGE BURBANK SHAT-

as been customary for the students of geology in this University to
requent excursions, during the autumn, to localities of special interest
vicinity of Baltimore, for the purpose of studying in the field the
nena which are systematically discussed in the lecture room. Thus
s season two excursions have been conducted into the Coastal Plain
, and others are already planned for the Piedmont Plateau. The
cursion took place on October 15, with Round Bay and Winchester
ective points. On the second, which took place one week later,
Point, at the mouth of the Patapsco, and Gibson Island, at the
of the Magothy river, were visited.

nd Bay is the name given to that portion of the Severn river lying
n Cedar and Arnold Points, where the stream suddenly changes its
ter from a narrow estuary confined between high banks, to that of a
lake-like expanse. On the northeastern shore of this body of water
s of deposits, extending from lower Cretaceous to Eocene, is exposed
high, vertical walls of the valley.

The most comprehensive section is laid bare on the sides of Mt. Misery, and may be briefly summarized as follows: The Raritan formation (lower Cretaceous), which lies at the base, is represented by a thin band of dark, bluish clay overlaid by a bed of coarse, white, cross-bedded sand, eight feet thick, which in turn is capped with a four-inch ferruginous band. Above this the Matawan (basal member of the upper Cretaceous) lies unconformably, and is composed of dark, glauconitic, fossiliferous clay, grading upward into a light-colored, sandy clay, in all attaining a thickness of some twenty-two feet. Conformably on this rests the Monmouth formation with four feet of green sand at base, overlaid by eight feet of white and red sand carrying marly layers From here upward for some distance the section is obscured by landslips and vegetation, but just below the one hundred foot contour the marls of the Rancocas formation appear, and forty feet below the top of Mt. Misery are unconformably overlain with a coarse fossil-bearing sandstone of Eocene age. About a mile northwest of Mt. Misery, in the vicinity of Cedar Point, the Raritan section is considerably thicker, and contains rolled, clay lumps evidently derived from underlying members of the Potomac group, which had been raised above sea level and were undergoing erosion at the time that the sands in this locality were being deposited. This whole series of formations enters Maryland from the neighboring state of Delaware, crosses the state from northeast to southwest, and slopes toward the southeast with an average dip of twenty-five feet to the mile, although locally it may depart somewhat from this angle. Owing to this dip the various beds, as they proceed toward the Chesapeake, successively approach the water line, skirt along the shore for a short distance, and finally disappear, one by one, beneath the waves.

At Winchester, a station on the Baltimore and Annapolis Short Line, about four miles down the dip from Round Bay, the Eocene deposits are beautifully exposed in an extensive railroad cutting. Here the formation is made up largely of fine sand carrying a little glauconite, and is stratigraphically higher and younger than the Eocene deposits which cap Mt. Misery. Although the deposits as a whole are not consolidated, nevertheless a partial induration has succeeded in binding the otherwise loose sand into a more coherent mass. Iron has largely served as the cement, and beautiful examples of concentric, cylindrical crusts are here visible. Fossils in the form of poorly preserved casts occur near the base of this cutting.

Through the courtesy of Hon. William T. Malster, who generously placed the steamboat "Baltimore" at the disposal of the Geological Department, the excursion to Bodkin Point and Magothy river was rendered more than usually enjoyable. Along the shore, about a mile below Bodkin Point, the variegated clays of the Raritan formation are finely exposed in a cliff some thirty feet in height. These clays occupy the greater portion of the section and carry an abundance of lignite more or less incrusted with crystals of pyrite. Sands and gravels of Pleistocene age unconformably overlie the clays and constitute the upper portion of the cliff. Half a mile further south the cliff still maintains its former height, but the section has changed. Some ancient stream must have established its valley on the Raritan sand, for here the surface of that formation, like a great concave depression, passes gradually beneath the beach to appear again in the cliff a hundred and fifty yards below. In this hollow, lying unconformably on the Raritan formation, is a bed of dark-colored clay about fifteen feet thick. Bluish and greenish tinted bands of clay relieve somewhat the somber aspect of this formation, and at about its middle portion it carries a bed of peat. But its most striking feature is the huge fossil cypress knees and stumps which are imbedded in its lower portion. These stumps vary in diameter from two to over ten feet, and after the removal of the surrounding clay, stand out prominently in the position in which they must have grown. Mr. A. Bibbins, to whom I am indebted for the above measurements, has counted thirty-two of these stumps which were visible at one time, and also reports finding worm-eaten beechnuts intimately associated with cypress cones near the base of the formation.[1] Sands and gravels of Pleistocene age overlie the whole unconformably. Immediately south of this outcrop the dark-colored clays are temporarily replaced by the Raritan formation, but they appear again a little further down the shore, and afford a good and almost unbroken exposure for about a mile. The thickness of the clay in this locality is at first about ten or twelve feet, but it gradually becomes thinner southward and finally disappears altogether. Casts of Unio shells, and not vegetable remains, are its predominant fossils, while, like the beds containing the cypress swamp, it overlies the Raritan formation unconformably, and is itself unconformably buried beneath Pleistocene sands and gravel.

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[1] This is the same deposit which has been described by Mr. A. Bibbins (*Plant World* Vol. I., 1898, pp. 164-166, with plate) as Raritan, but the writer believes it is very much younger.

The peculiar topographic relations and physical composition of the clays in these two exposures call to mind other deposits of similar character which the writer has examined at several localities in other parts of Maryland. Perhaps the most striking of these deposits is exposed on the Bay shore, about a mile northeast of Drum Point. Here, at the base of a cliff about thirty feet high, is a two foot bed of dark, chocolate colored clay carrying gnarled and twisted sticks protruding in every direction from the material in which they are imbedded. Above this occurs a thin seam of lignite one and a half feet thick, which in turn is overlain with about five feet of slate-colored clay. At this point the continuity of the deposit is interrupted by an unconformable series of sands, clays and gravels, of Pleistocene age, which extend upward to the top of the cliff. Although the base of this lignitic clay series is buried beneath beach sands, yet field relations lead to the conclusion that the deposit is very much younger than the Miocene clays on which it is believed to rest unconformably. A similar section is to be seen on the Patuxent river, about a mile below Soller's Landing. Large stumps here protrude from a dark, basal clay bed, some five feet in thickness, which is covered by three feet of sand, and this again buried unconformably beneath ten feet of Pleistocene sand and gravel. The relations of the basal clay to the underlying Miocene is again obscure, but indications point to an unconformity. A third section is exposed along the shore one and one-half miles northwest of Cedar Point, where a thin bed of drab clay carrying vegetable remains is overlain unconformably with sands and gravels. Its contact with the Miocene is again unfortunately obscure. At the three localities just described no animal remains have been discovered, but on the north bank of the Potomac, about half way between St. Mary's River and Breton Bay, there is a deposit of lead-colored clay, exposed for a quarter of a mile along the shore. Buried at each end as well as above by sands and gravels, it carries both lignite and Gnathodon cuneata Conr., and shows by its unconformability with the gravels that it was raised and considerably eroded before they were deposited. Although the description given by Conrad is somewhat vague, it is highly probable that he visited this locality and collected specimens of the fossils. Two more localities still remain to be mentioned, Cornfield Harbor, and its companion deposit exposed five and a half miles south of Cedar Point on the Bay shore. Conrad was well acquainted with these deposits and to the former he devoted special attention. Each is about ten feet thick, occurs at the base of a low cliff, is composed mostly of a dark, lead-colored clay, and is overlain unconformably with Pleistocene sand and gravel, while unconformity on the Miocene is beautifully shown at the base of the Bay shore section. A number of fossils have been described from the Cornfield Harbor locality, among which are Ostrea Virginica Gmelin, Arca ponderosa Say, Arca transversa Say, Venus mercenaria Linn., Mya arenaria Linn., Pholas costata Linn., Crepidula plana Say, Natica duplicata Say, Busycon carica Gmelin. Of these many and possibly all occur in the Bay shore deposit.

It will now be seen that these deposits, scattered along the margin of Chesapeake Bay from the buried cypress swamp below Bodkin Point to the classic locality near Cornfield Harbor, all strikingly resemble each other: for they are composed of dark, compact clay, occur at tide, at the base of low cliffs whose tops are far beneath the general level of the surrounding country, along ancient river channels, have suffered considerable erosion, are unconformably buried beneath Pleistocene strata, and are unconformable on the older deposits wherever the contact is visible. The point in which they differ most widely is in the character of their organic remains, but this contrast is just what one would expect to find if the deposition of the lignitic clay took place in fresh water swamps, while the other beds were laid down in regions more easily influenced by the ocean. Similar deposits are being formed side by side along our coast to-day.

One cannot see these deposits without being strongly impressed with their similarity to the Fish House clays of New Jersey. Whether all or any of them are contemporaneous is not known, and a comprehensive definition or reliable correlation would, at the present state of our knowledge, be premature, but one cannot help feeling that these various deposits, from Fish House to Cornfield Harbor may prove, in the light of further investigation, to be isolated remnants of the same geologic formation.

The expedition concluded with an examination of the cliff on the south side of Gibson Island, facing the Magothy. Upper Cretaceous beds compose most of this section, and the Matawan, Monmouth, and Rancocas formations may be seen finely exposed in the bank.

Johns Hopkins University, *November* 2, 1898.

An Episode during the Terrace Cutting of the Potomac. By Cleveland Abbe, Jr.

While studying the graveled terraces which are marked features of the Potomac valley in the vicinity of Cumberland, Maryland, the writer came upon a very interesting piece of evidence of stream action during one of the earlier terracing epochs.

Five or six miles west of Cumberland the Baltimore and Ohio Railroad passes a cliff of vertically bedded Lewistown limestone and Rockwood shales on the northwest bank of the Potomac river. The shales are very fissile and generally thin bedded between thin bands of an impure limestone; while the Lewistown limestone is relatively more massive. These physical characters and their vertical attitude combine to make the cliffs easily and rapidly scored by the agents of denudation and erosion and the result is that deep aisles or shafts have been carved in the cliffs by wind and rain. In one of the less resistant bands of the Lewistown limestone, very near the top of the shales and about 50 yards from "Potomac Station" a cave has been hollowed out. This cave or recess at present has a width of eight or nine feet, a height of fifteen feet above the railroad bed and a depth of ten feet in from the face of the cliff. These measurements however, do not indicate the original size of the cave. The cutting necessary for the construction of the railroad bed has removed twelve or fourteen feet of the bank so that an equal number of feet should probably be added to the present depth in order to obtain a measure of the original depth of the cave; and the maximum height and width are masked by the road bed and removal of material.

As first seen from the railroad track the cave appears rather commonplace since there are numerous smaller recesses worn out from the soft shales of the vicinity as has been observed above. A second look, however, revealed some interesting points. In the back part of the cave was noticed a massing of fragments of shale and limestone with their flat sides laid horizontally, while above and around them the rocks stand with their clearly defined bedding planes in a vertical position. On entering the recess and examining the interior more closely it was at once evident that the cave had been filled with a mass of stratified gravels, sandy clay and angular or subangular shale fragments. The floor of the cave is sandy clay strewn with gravels and cobbles some of which lie in a heap at the entrance, while at the back of the recess and along the right side a considerable volume of the filling material still stands *in situ*. To a height of four or five feet from the present cave floor the filling material is a sandy clay packed with well rounded quartz gravels averaging ¾ to 1 inch in diameter. The pebbles are most thickly set near the base, becoming somewhat more loosely clustered four or five feet up. Occasionally this gravelly layer contains large rounded quartz cobbles 12 to 15 inches in diameter. No large cobbles were seen in place, but three or four of them lying on the present cave floor would seem to have come from this layer since it is the most suitable and nearest source. There is no convenient external source for them and although the cave shows signs of recent human occupation there seems to be no reasonable motive for the introduction of the cobbles through human agencies. The gravel and cobble layer is overlain by one and a half or two feet of the clay with rarely a pebble or fragment of shale. At the top a bed of angular fragments of shale and one or two quartz pebbles, extends nearly or quite to the roof of the cave. The walls of the cave show such evidences of solvent action as commonly characterize the soluble limestone outcrops in the fields, although here within the cave the effects of the solution are less pronounced. Because of this solvent action it was difficult to determine with certainty whether or no the cave walls had suffered any corrasion by the action of running water, and no clear evidence of such action was found.

Significance of the Cave-deposits.—It is a significant feature of the deposit in the cave that its character changes from gravels and cobbles in its lower

to clays and angular fragments of shale at the top. The large
and cobbles composing the lower four or five feet of the deposit
ndicate that during the earlier part of the cave's history strong
urrents were flowing through and past the cave. In no other way
ccount for the presence in the cave, of well rounded gravels of a
so foreign to the locality as vein quartz is. During this period
ments of limestone that may have fallen from the roof or been
n the sides seem to have been ground to pieces by the rushing waters
ied away for no fragments were found mixed with the gravels of
sits. The upper portion of the deposit is sharply distinguished
lower by its clay bed and the absence of quartz gravel, the latter's
ing taken by the fragments of shale. All these features indicate
waters in the cave were much quieter during the later stages of its

While the one or two feet of clay were being formed the waters
re been much quieter and loaded only with silt and sand, a condition
usibly explained in this case by supposing the stream to have shifted
nel so that only the slower currents reached the cave. The upper
unworn angular shale fragments probably indicates a slight increase
orce of the current flowing by the cave, but not a return of the
onditions. The question of the source of these shale fragments is of

They may have been brought in from the ledges of shale that are
outside the cave; or it may be that the cave formerly extended
its present limits in the limestone and included a portion of the
ring shales and that these fragments were thus derived from the
alls of the cave itself. In either case the angular shapes of the
ts indicate that they were not transported over any considerable
and that the currents were not very swift.

on of Cave and Gravels to Terraces.—The chief interest that this
ve possesses arises from its relations to the stream terraces and
in its vicinity. There are along this portion of the Potomac two
terrace-levels above the present bottom-lands or flood plain of
mac. The flood plain is itself somewhat easily to be mistaken for
since it stands six or eight feet above the channel of the river and
ated. The front of the first terrace rises rapidly from its sinuous
ion with the floodplain, to an elevation of about twenty feet above
hen changes to the very gently sloping bench that extends back
ndred feet to the front of the second terrace. Along the front of
nd terrace and on the surface of the first terrace run the tracks
altimore and Ohio Railroad. The second terrace rises twenty to
ive feet above the level of the railroad tracks and always has a
ore sharply marked and steeper slope than the first terrace but it is
h more extensively dissected by recent drainage lines. This second
as is described in another paper, is strewn with gravels and cobbles
th of two or three feet yet a section cut in it by a small stream near
liff station proves conclusively that the terrace owes its origin more
laning down of the yielding shales of the Lewistown than to the con-
action of the river.

two terraces with less distinct traces of a third higher one can be
ore or less continuously along the Potomac for a number of miles.
in interest attaching to them for our present discussion arises from
cidence in elevation above present stream channels, of the second
ront and the gravel-filled cavern already described.

y of the Cave.—The two features of the cave that seem to be most
nt are, first, that it stands not in the face of the front slope of the
errace, but is hollowed out at a corresponding elevation in a higher
whose base the Potomac now runs); and second, that it is filled
eam-worn gravels and boulders.

let us consider the question of origin of the cave. There are two
ses according to either one of which the existence of the cave might
ined. (a) The cave may be the product of subterranean stream
aving been dissolved out of the limestone by some small stream
ckled down through the vertical joint-planes and laminæ of the
his explanation is supported by the fact that the walls of the cave
signs of solvent action and that it has the narrow rather angular
of a subterranean water course. The absence of any indications of
channel or inlet is against the theory. The filling of gravel may,
mask such an entrance. (b) Again we may regard the cave as
een hollowed out by the lateral cutting of the river when it stood
evel and swept against this bank as it does to-day. The presence
ve-deposit of the large rounded quartz boulders proves that there were strong currents flowing past the cave during the deposition of the earlier portion of its filling. This suggests that the rapid flowing stream armed with flint as it was, wore away the yielding rocks at this point where the river turned against them most sharply, hollowing out a shallower, broader cavern whose inner portion only is now revealed to us. Such an origin for the cave would leave its marks on the walls of the latter in the form of abrasion marks, and would also leave slight traces of solvent action by the waters carrying the abrasive materials. The walls of the cave do not show any markings that may be definitely assigned to stream wear such as has been suggested. Solution has clearly borne some part in the cavern's growth for as has already been noticed the walls show the rounded and smoothed corners and edges that characterize such work. Such results may have come through subterranean stream action, however, as easily as from river work and do not in themselves yield any criterion for the determination of the agent.

There are, therefore, no definite lines of evidence on which to base a final explanation of this cave. The clearest and most striking facts, particularly the presence of large, rounded quartz boulders and the probable long continued concentration of stream force at or near this point, give strong presumption in favor of origin by lateral or horizontal corrasion. It is possible, perhaps even probable that this horizontal corrasion by the gravel-loaded stream was definitely concentrated at this point by the cavern of a small subterranean stream.

The period of this cavern-cutting is indicated by the relation between the cave-gravels and the terraces with their gravel-veneer. The cave, by its location must have been formed during the period when the river was cutting down from the Second Terrace to the First Terrace. Standing as it does between the elevations of the front top of the Second Terrace and the back of the First Terrace the position of the cave is just where a stream cutting down from terrace to terrace would be likely to hollow out a recess during its progress downwards. The gravels now lying in the cave are most closely connected, through elevation, with the gravels lying on the First Terrace and the front slope of the Second. They rise higher than these latter gravels but not quite to the level of the Second Terrace, whence one infers that these cave-gravels are, like the cave, intermediate in age between the older Second Terrace and the younger First Terrace. The writer has not as yet definitely correlated these terraces about Cumberland with the Pleistocene deposits lower down the Potomac.

REPORT OF THE WORK OF THE GEOLOGICAL DEPARTMENT DURING THE SESSION OF 1897-98.

By W. B. Clark.

The Geological Laboratory was open daily throughout the year to graduate and undergraduate students. The quarters have been considerably enlarged by the addition of a series of rooms upon the lower floor of the rear building attached to Hopkins Hall, as well as by the construction of a machine shop for the conduct of the experimental work connected with the Maryland Geological Survey.

The instruction in Geology has been somewhat modified by the withdrawal of Mr. G. K. Gilbert of the U. S. Geological Survey who for several sessions delivered important courses of lecures upon physiographic geology. Professor Cleveland Abbe of the U. S. Weather Bureau has been attached to the corps of instructors and will give a few lectures upon meteorological topics in the future.

During the past year the following courses of instruction were given:

(*a*) General Geology, by Professor Clark and Dr. Shattuck. *Four lectures and one afternoon in practical work each week throughout the year.*

(*b*) Historical Geology, by Professor Clark. *Two lectures each week throughout the year.*

(*c*) Geological Physics, by Associate Professor Reid. *Two lectures each week from February to May.*

(*d*) Mineralogy, by Dr. Mathews. *Three lectures each week throughout the year.*

(*e*) Petrography, by Dr. Mathews. *Two lectures each week from October to February.*

(*f*) Climatology, by Mr. Fassig. *Fifteen lectures in October and November.*

(*g*) Stratigraphic and Structural Geology, by Mr. Willis. *Two lectures each week from March to June.*

(*h*) Scandinavian Geology, by Professor Hans Reusch. *One lecture in March.*

(*i*) Topographic Methods, by Mr. H. M. Wilson. *Three lectures in May.*

(*j*) Rocks and Rock Weathering, by Professor G. P. Merrill. *One lecture in November.*

(*k*) Geological Conferences. *Fortnightly throughout the year.*

(*l*) Student lectures. *Fortnightly from December to May.*

Original Work and Publications. Geological work was continued by Professor Clark upon the older Coastal Plain deposits of the Middle Atlantic Slope with the coöperation of Dr. R. M. Bagg, Jr., and Mr. A. Bibbins. A report was prepared for the Geological Survey of New Jersey upon the Cretaceous formations of that State. Several other papers were published on various phases of Coastal Plain work. Professor Clark also contributed an article to the Journal of Geology in "A Symposium on the Classification and Nomenclature of Geologic Time Divisions." Professor Clark was actively employed throughout the year in the management of the State Geological Survey and in the preparation for publication of the second volume of its reports.

Associate Professor Reid, as a member for the United States of the International Committee on Glaciers, was engaged in collecting information regarding the various American glaciers. He continued his work upon the movement and stratigraphy of glacier ice, spending a portion of the summer and autumn of 1897 in eastern Switzerland in the accumulation of additional data. Dr. Reid is Chief of the Division of Highways of the Maryland Geological Survey.

Dr. Mathews continued his investigations upon the crystalline rocks of the northern counties of the State. He made an extended study of the building-stones of Maryland and the industries founded thereon, and has prepared an elaborate monograph in connection with Professor Merrill of the U. S. National Museum upon this subject. Dr. Mathews has also been engaged during a portion of the year in an investigation of the maps and map-makers of Maryland, which he will present in the form of a report in the next volume of the Maryland Geological Survey. As Assistant State Geologist, Dr. Mathews was also engaged in the management of the State Geological Survey.

Mr. Fassig, in addition to his work in connection with the Baltimore office of the U. S. Weather Bureau, has been making a study of the history of climatological investigations in Maryland, preparatory to the publication of a report upon that subject in the new series of the Maryland Weather Service.

Dr. Shattuck began, during the summer and autumn of 1897, a study of the gravels about the head of Chesapeake Bay, preparatory to the mapping of the several gravel formations of the eastern section of the State. This work was continued on a wider scale the present summer. Dr. Shattuck also investigated the Tertiary fossils secured by Professor Robert T. Hill, of the U. S. Geological Survey in Jamaica, and will prepare a palaeontological paper to accompany Professor Hill's report upon the geology of that island.

Three candidates presented themselves in June for the degree of Doctor of Philosophy. The first, Mr. Cleveland Abbe, Jr., carried on an investigation upon the physiography of the State with especial reference to the development of the streams of the Piedmont Plateau, and his report will be published by the State Geological Survey; the second, Mr. C. C. O'Harra, carried on a very thorough investigation of the stratigraphy, structure, and mineral resources of Allegany county which will be published both as a special report and as part of a later volume upon the descriptive geology of Maryland; the third, Mr. A. G. Leonard, was engaged in a study of the relations of the basic to the acid eruptive rocks of Cecil county, an investigation started during a period of earlier academic residence under the direction of Professor Williams. The results of this investigation will be published as a Bulletin of the U. S. Geological Survey.

Several other investigations were undertaken by different members of the Department and will result in later communications.

Excursions and Geological Camp. Numerous short excursions were made during the autumn months into the region immediately adjacent to Baltimore, both in the Coastal Plain and the Piedmont Plateau. The long excursion commonly made in the spring was replaced by the establishment of a permanent camp in the vicinity of Cumberland in the heart of the Appalachian Mountains, where, under the several instructors, the regular work of the Department was continued during several weeks in May. Special lecturers connected with the scientific bureaus in Washington were secured, who gave practical instruction to the students in field methods, in climatology, topography, hydrography, and agricultural soils. These subjects were daily studied as well as the more important problems presented by the geology of the district.

Scientific Societies. The fortnightly meetings of the Geological Society of Washington were attended from time to time during the winter by the instructors and students of the Department, all of whom were elected non-resident members of that organization. Several members of the Department also became members of the National Geographic Society and availed themselves of its privileges. The results of many of the most noteworthy investigations of the year are presented to these societies, and attendance at the meetings is considered an important part of the students' work.

International Geological Congress. Professor Clark and Dr. Reid were in attendance as delegates from the University (Professor Clark was one of the National delegates, and also carried the credentials of the Governor of Maryland as State Geologist) at the Seventh International Congress of Geologists at St. Petersburg during the summer and autumn of 1897. They were allowed a period of absence for the early part of the academic year, and during this time extended their travels throughout European Russia as well as into the adjacent Asiatic provinces. They brought back valuable materials for the University collections.

Professor Clark was appointed a member of the International Committee on the Unification of Geological Nomenclature, and Dr. Reid a member of the Committee on Glaciers.

The Abbe Meteorological Library. Professor Cleveland Abbe, of the U. S. Weather Bureau, presented to the University, during the year, his important collection of books upon meteorological subjects. This library is regarded as one of the most complete in this country, and will prove of great value to students who are intending to carry on investigations in the field of meteorology. The library has been already placed in a room in the Geological Laboratory especially prepared for it, and Mr. Fassig acts as special librarian of the collection. This generous gift of Professor Abbe is very highly appreciated, and it is believed that it will do much to arouse an interest in meteorology in Maryland.

Apparatus and Collections. Several important additions were made to the apparatus and collections during the year. The library was considerably enlarged by the addition of several important serials and much needed geological maps. Several valuable collections of rocks and fossils were also acquired.

COLLECTION OF EOCENE FOSSILS.

A large number of Maryland and Virginia Eocene fossils have been secured during the past season by Dr. R. M. Bagg. This new material will very largely enhance the value of the collections of the University from this horizon, especially since many new species have been found, and the already recognized forms so largely increased in number of individuals as to give better comparative material.

Highly important results have been secured from a stratigraphic standpoint since the boundary between the two Maryland Eocene faunas has been definitely determined at many points. These results will make it possible to represent upon the State maps the two different divisions of the Maryland Eocene.

The writer desires to correct the use of the name *Pecten rogersi*, applied to a new species of this genus from the Middle Atlantic slope Eocene in an earlier report,[1] on the ground of the pre-occupation of the term. The name *Pecten dalli* is proposed in its place, and will be incorporated in the report upon the Maryland Eocene which will be later published. The species referred to was secured from Potomac Creek, Virginia, and belongs to the lower or Acquia Creek fauna.

W. B. C.

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[1] J. H. U. Circulars, Vol. XV, p. 5, 1895; Bull. U. S. Geol. Surv., No. 141, p. 85, pl. XXXIV, figs. 2a–c, 1896.

LICATIONS OF THE MARYLAND GEOLOGICAL SURVEY.

Maryland Geological Survey has already published several articles
to the physical features of Maryland. Most of these have been
together in Volume I of the series of Survey reports, which appeared
1897. This first volume contains historical and geological chapters
g the present knowledge of Maryland geology together with a com-
ological bibliography and cartography of the State. An exhaustive
pon the magnetic conditions of Maryland is also included in this
These several articles have been published both as independent
and combined in volume form.

the publication of the first volume a report has been issued upon
vey of the Boundary-line between Allegany and Garrett counties,
ppeared in September of the present year. Other reports dealing
e Building Stones of the State and with the Maps and Map-makers
land, the latter introduced by a chapter upon the Aims and Methods
graphy, have been prepared. These will constitute Volume II of
es of official reports, and will be issued from the press during the
month.

reports dealing with the Physiography of the State and the de-
eological features of portions of Western Maryland are already in
ript and will be issued as Volume III as soon as the proper base-
n be prepared.

progress has already been made in the preparation of the manu-
f the Report upon Highway Construction which will constitute
IV, and which is required by legislative act to be presented at or
the next session of the General Assembly in January, 1900.

e four volumes, already printed or in manuscript, will present to the
of the State a discussion of many subjects of economic and educa-
importance. Much additional material has been already collected
can be in the near future brought together in the form of reports.
f this work will be delayed in publication until the preparation of
essary topographic maps which are now under construction by a
coöperation with the U. S. Geological Survey which was authorized
last session of the General Assembly.

W. B. C.

URES IN GEOLOGY AND PHYSICAL GEOGRAPHY FOR BALTIMORE TEACHERS.

esponse to a request for lectures especially adapted to the needs of
ore teachers, the Johns Hopkins University offers, during the current
ic season, two classes of instruction: one on historical, the other on
ic subjects.

Scientific Course which embraces lectures in Geology and Physical
phy, began on Saturday, November 5, 1898, at 9.30 a. m., in McCoy
nd will continue at the same hour on successive Saturdays until the
is completed. The lectures will be chiefly given by Dr. George B.
k.

ographies and printed outlines of each lecture are furnished without
e to the hearers. Each lecture is preceded by a review of the
s lecture. Questions for written answers, which may be sent to the
r by those who are so inclined, are given out from time to time, or
in the syllabus, for the purpose of stimulating study at home. A
examination will be set at the end of each course, and the papers
ted will be returned to the writers with corrections or helpful sug-
s. A simple certificate covering attendance and class work will be
t the end of the Course.

following is a syllabus of the lectures given:

mber 5, Atmosphere; 12, Rain; 19, Rivers in General.
mber 3, Classification of Rivers; 10, Life history of Niagara; 17,
kes.
ary 7, Oceans; 14, Ice in General; 21, Glaciers; 28, Organisms.
uary 4, Volcanoes; 11, Mountain Building and Uplift in General;
Distribution; 25, Paleontology.
h 4, Precambrian; 11, Paleozoic; 18, Mesozoic; 25, Tertiary.
l 8, Quarternary; 15, History.

Professor Clark opened the Course in a short address explaining the methods to be pursued, and introduced the lecturer. The hearty response on the part of the teachers is very gratifying to the committee in charge of the Teachers' Course. At the present time the class numbers one hundred and seven while ninety more teachers attend the lectures.

G. B. S.

At a meeting of the Zoölogical Journal Club of the Johns Hopkins University, November 7th, 1898, Dr. H. McE. Knower told of the sudden death, on November 4th, of Dr. **James Ingraham Peck**, Assistant Professor of Biology in Williams College, and Sub-Director of the Marine Biological Laboratory of Wood's Holl, Mass.

As Dr. Peck had been associated, while a student in the Johns Hopkins Biological Laboratory, with some of those present, a special meeting was called to afford an opportunity for an expression of the sorrow felt in the loss of one whose short life had been so full of usefulness.

On the following day, those who had been instructors and fellow students of Dr. Peck in this University met together, with many who had known him and studied under him at Williams College and at Wood's Holl, and adopted the following minute:—

Whereas, we cannot forget that James Ingraham Peck exemplified, in his own short life, all those high qualities of enthusiasm for truth, of devotion to scientific research, and of earnestness in the instruction of others, which it is the chief aim and best reward of a university to diffuse among men;

We therefore resolve, that while we mourn the untimely loss of one who had been the earnest and faithful pupil of some among us, the enthusiastic and inspiring fellow student, or the patient, kindly, and helpful teacher of others, we are glad to remember his devotion to the highest and best work of a learned man, and his success in handing on to his associates his unselfish enthusiasm in the pursuit of truth.

And be it further resolved, that copies of these resolutions be sent to the family of Dr. Peck, and to the Johns Hopkins University Circular.

Daniel C. Gilman, *President, Johns Hopkins University.*
W. K. Brooks, G. P. Dreyer,
W. H. Howell, R. G. Harrison,
E. H. Griffin, H. McE. Knower,
F. P. Mall, E. N. Riggins,
E. A. Andrews, *Committee.*

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Edited by Professor WILLIAM K. BROOKS, Ph. D., LL. D.

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II.—The Systematic Affinity of Salpa in its relation to the Conditions of Primitive Pelagic Life; The Phylogeny of the Tunicata; and the Ancestry of the Chordata. Chapter VI.—The Systematic Position of Salpa. Chapter VII.—Salpa in its Relation to the Evolution of Life. Chapter VIII.—The Origin of the Chordata, considered in its relation to Pelagic Influences.

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D. S. Johnson, On the Development of the Leaf and Sporocarp Marsilia quadrifolia, L.
George Lefevre, Budding in Perophora.
H. McE. Knower, The Development of Termites.

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JOHNS HOPKINS UNIVERSITY CIRCULARS

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VOL. XVIII.—No. 138.] BALTIMORE, DECEMBER, 1898. [PRICE, 10 CENTS.

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Mathematics and Astronomy. (74 Students).

Classes meet in the Physical Laboratory, except as otherwise stated.

Advanced Theory of Functions: Professor CRAIG. Monday, Tuesday, Thursday, 9 a. m., Room 26. (5).

Eisenhart, L. P.
James, G. O.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Theory of Surfaces: Professor CRAIG. Monday, Tuesday, Thursday, 10 a. m., Room 26. (5).

Eisenhart, L. P.
James, G. O.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Mathematical Conference: Professor CRAIG. Friday, 10 a. m. to 12 m., Room 26. (5).

Eisenhart, L. P.
James, G. O.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Theory of Substitutions: Dr. COHEN. Monday and Wednesday, 12 m., Room 26. (5).

Eisenhart, L. P.
James, G. O.
Lucke, H. J.
McInnes, C. R.
Wallis, W. F.

Theoretical Mechanics: Dr. COHEN. Wednesday and Friday, 9 a. m., Room 26. (6).

Eisenhart, L. P.
James, G. O.
Lucke, H. J.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Elementary Theory of Functions: Dr. COHEN. Monday and Tuesday, 11 a. m., Room 26. (10).

Coble, A. B.
Eisenhart, L. P.
Gilbert, N. E.
James, G. O.
Lucke, H. J.
McInnes, C. R.
Parsons, L. A.
Pender, H.
Potts, L. M.
Wallis, W. F.

Differential Equations: Dr. COHEN. Tuesday and Friday, 8 a. m., Room 27. (8).

Coble, A. B.
Kent, N. A.
Kinsley, C.
Loving, R. E.
Meyer, J. F.
Nightingale, C. E.
Parsons, L. A.
Tondorf, F. A.

Determinants; Calculus (*Special Topics*)***; Theory of Equations:*** (*Major Course*)*:* Professor HULBURT. Daily, except Monday, 9 a. m, Room 27. (14).

Baetjer, H.
Brooks, C. E.
Cator, G.
Coble, A. B.
Estill, H. S.
Foster, F.
Francis, I. H.
Hyde, E. P.
Kerr, R. C.
Loving, R. E.
Morrison, C. J.
Smith, W. L.
Tondorf, F. A.
Wirt, C. B.

Analytic Geometry; Calculus: (*Minor Course*)*:* Professor HULBURT. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., Thursday, 12 m, Room 27. (23).

Bandel, J. M.
Beck, G. C.
Bruton, A. W.
Cronin, F. H.
Foutz, C. R.
Guenther, F.
Hatch, E. C.
Hill, H. D.
James, R.
James, W. McC.
Moore, J. H.
Morrison, C. J.
Morse, R. B.
Preston, J. O.
Russell, G. W.
Smith, R. T.
Stein, J. S.
Straus, H. P.
Uhrbrock, R. H.
Warner, H. M.
Wolf, M. W.
Wright, H. C.
Zies, F.

Elementary Solid Geometry; Plane Trigonometry: Dr. COHEN. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., Thursday, 12 m., Room 7, McCoy Hall. (17).

Bird, A. R.
Bye, M.
Cook, T. G.
Diggs, C. F.
Fenwick, B. L.
Hazen, H. H.
Hill, W. B.
Jenness, P.
Lilly, W. L.
Lisberger, S. J.
Lowndes, E.
Maury, R. M.
Mower, McH.
Raffel, H. B.
Reeves, E. D.
Stephens, J. L.
Strouse, E.

Theoretical Astronomy: Associate Professor POOR. Wednesday, 10 a. m., Thursday, 12 m., Room 34. (2).

Gilbert, N. E.
Wallis, W. F.

Spherical and Practical Astronomy: Associate Professor POOR. Monday and Wednesday, 2 p. m., Room 34. (6).

Coble, A. B.
Lindley, W. P.
Loving, R. E.
Lucke, H. J.
Moore, J. H.
Palmer, E. L.

General Astronomy: (*Undergraduate Elective*)*:* Associate Professor POOR. Monday, 9 a. m., Tuesday, 10 a. m., Room 34. (4).

Flinn, F. B.
Routh, J. E.
Taveau, R.
Werber, O. S.

Observatory Work: Associate Professor POOR and Dr. DORSEY. Daily. (8).

Coble, A. B.
Eisenhart, L. P.
Lindley, W. P.
Loving, R. E.
Lucke, H. J.
Moore, J. H.
McInnes, C. R.
Palmer, E. L.

Physics. (92 Students).

Classes meet in the Physical Laboratory.

Electricity and Magnetism: Professor ROWLAND. Daily, except Wednesday, 10 a. m., Room 24. (11).

Gilbert, N. E.
Huff, W. B.
Kent, N. A.
Kinsley, C.
Merrill, J. F.
Meyer, J. F.
Novak, V.
Potts, L. M.
Reese, H. M.
Saunders, F. A.
Southall, J. P. C.

Spectrum Analysis: Professor AMES. Thursday and Friday, 11 a. m., Room 24. (16).

Gilbert, N. E.
Huff, W. B.
James, G. O.
Kent, N. A.
Kinsley, C.
Lucke, H. J.
Merrill, J. F.
Meyer, J. F.
Parsons, L. A.
Pender, H.
Potts, L. M.
Reese, H. M.
Saunders, F. A.
Southall, J. P. C.
Tondorf, F. A.
Turner, H. J.

Physical Seminary: Professor AMES. Saturday, 9 a. m., Room 23. (17).

Bliss, W. J. A.
Dorsey, N. E.
Gilbert, N. E.
Huff, W. B.
Kent, N. A.
Kinsley, C.
Lucke, H. J.
Merrill, J. F.
Meyer, J. F.
Parsons, L. A.
Pender, H.
Potts, L. M.
Reese, H. M.
Saunders, F. A.
Southall, J. P. C.
Tondorf, F. A.
Waldner, C. W.

Journal Meeting: Professor ROWLAND and Professor AMES. Wednesday, 11 a. m., Room 23. (21).

Bliss, W. J. A.
Dorsey, N. E.
Fassig, O. L.
Gilbert, N. E.
Huff, W. B.
Jones, H. C.
Kent, N. A.
Kinsley, C.
Lucke, H. J.
Merrill, J. F.
Meyer, J. F.
Mitchell, S. A.
Novak, V.
Parsons, L. A.
Pender, H.
Potts, L. M.
Reese, H. M.
Saunders, F. A.
Southall, J. P. C.
Tondorf, F. A.
Waldner, C. W.

General Physics: (*Major Course*)*:* Professor AMES. Daily, except Thursday, 12 m., Room 18. (18).

Beck, G. C.
Case, W. A.
Cator, G.
Estill, H. S.
Foutz, C. R.
Francis, I. H.
Gilbert, N. E.
Illmer, L.
James, R.
Kent, N. A.
Liddell, D. M.
Loving, R. E.
Morrison, C. J.
Olsen, J. C.
Parsons, L. A.
Routh, J. E.
Southall, J. P. C.
Tondorf, F. A.

General Physics: (*Minor Course*): Professor AMES. Daily, except Tuesday, 10 a. m., Room 18. (44).

Baetjer, H.
Baldauf, L. K.
Bonsteel, J. A.
Booker, J. M.
Braun, J.
Brooks, C. E.
Brownlee, R. H.
Chatard, J. A.
Coble, A. B.
Constantine, C. W.
Foster, F.
Frazer, J. C. W.
Garner, W. W.
Griffith, W. A.
Hill, H. D.
Hyde, E. P.
Jenness, P.
Jungbluth, M.
Kerr, R. C.
Leopold, E. J.
Machen, J. G.
Miller, H. C.
Moore, J. H.
Mower, F. D.
Perkins, H. F.
Powell, M. W.
Preston, J. O.
Rehberger, G. E.
Riggins, J. A.
Shippen, L. P.
Shreve, O. F.
Smith, W. L.
Snavely, G. E.
Stein, L. D.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Taveau, R.
Vogeler, C. A.
West, A. P.
Wilkinson, A. L.
Wirt, C. B.
Wright, H. C.
Zies, F.

Applied Electricity: (*Second Year*): Associate Professor HUTCHINSON. Monday and Tuesday, 9 a. m., Room 24. (12).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Huff, W. B.
Kent, N. A.
Kinsley, C.
Merrill, J. F.
Pender, H.
Schoepf, T. H.
Stephens, J. C.
Swaine, J. W.

Applied Electricity: (*First Year*): Associate Professor HUTCHINSON. Wednesday and Thursday, 9 a. m., Room 24. (6).

Fitzgerald, T.
Huff, W. B.
Jenness, P.
Nightingale, C. E.
Pender, H.
Schoepf, T. H.

Electrical Seminary: Associate Professor HUTCHINSON, Mr. HERING, Mr. GEER. Monday, 11 a. m., Room 23. (11).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Fitzgerald, T.
Illmer, L.
Jenness, P.
Nightingale, C. E.
Schoepf, T. H.
Stephens, J. C.
Swaine, J. W.

Electrical Measurements: Mr. HERING. Tuesday, 11 a. m., Friday, 9 a. m., Room 24. (6).

Fitzgerald, T.
Illmer, L.
Jenness, P.
Nightingale, C. E.
Pender, H.
Schoepf, T. H.

Steam and Hydraulic Engineering: Mr. GEER. Wednesday, Thursday, Friday, 10 a. m., Room 27. (7).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Schoepf, T. H.
Stephens, J. C.
Swaine, J. W.

Mechanics of Engineering: Mr. GEER. Monday and Tuesday, 10 a. m., Rooms 18 and 27. (6).

Estill, H. S.
Fitzgerald, T.
Illmer, L.
Nightingale, C. E.
Pender, H.
Schoepf, T. H.

Laboratory Work: Professor ROWLAND, Professor AMES, Associate Professor HUTCHINSON, Mr. HERING, Mr. GEER, Dr. BLISS, Dr. DORSEY, Dr. WAIDNER, Mr. WHITEHEAD. Daily, 9 a. m–5 p. m. (82).

Armstrong, J. R. C.
Baetjer, H.
Baldauf, L. K.
Beale, R. B.
Beck, G. C.
Beeuwkes, R. K.
Bonsteel, J. A.
Booker, J. M.
Braun, J.
Brooks, C. E.
Brownlee, R. H.
Case, W. A.
Cator, G.
Chatard, J. A.
Coble, A. B.
Constantine, C. W.
Estill, H. S.
Everett, W. T.
Fitzgerald, T.
Foster, F.
Foutz, C. R.
Francis, I. H.
Frazer, J. C. W.
Garner, W. W.
Gilbert, N. E.
Griffith, W. A.
Guenther, F.
Hill, H. D.
Huff, W. B.
Hyde, E. P.
Illmer, L.
James, R.
Jenness, P.
Jungbluth, M.
Kent, N. A.
Kerr, R. C.
Kinsley, C.
Leopold, E. J.
Liddell, D. M.
Loving, R. E.
Lucke, H. J.
Machen, J. G.
Merrill, J. F.
Meyer, J. F.
Miller, H. C.
Moore, J. H.
Morrison, C. J.
Mower, F. D.
Nightingale, C. E.
Novak, V.
Parsons, L. A.
Pender, H.
Perkins, H. F.
Potts, L. M.
Powell, M. W.
Preston, J. O.
Reese, H. M.
Rehberger, G. E.
Riggins, J. A.
Routh, J. E.
Saunders, F. A.
Schoepf, T. H.
Shippen, L. P.
Shreve, O. F.
Smith, W. L.
Snavely, G. E.
Southall, J. P. C.
Stein, L. D.
Stephens, J. C.
Straus, H. P.
Struth, O. A.
Swaine, J. W.
Swindell, W. B.
Taveau, R.
Tondorf, F. A.
Turner, H. J.
Vogeler, C. A.
West, A. P.
Wilkinson, A. L.
Wirt, C. B.
Wright, H. C.
Zies, F.

Special Course in Experimental Physics for Medical Students: Dr. WAIDNER. Saturday, 9 a. m.–12 m. (7).

Chase, L. A.
Dolley, D. H.
Dunlop, J.
Ferry, N. S.
Grant, J. F.
Ludlum, S. D.
McFarland, J. S.

Chemistry. (104 Students).

Classes meet in the Chemical Laboratory, except as otherwise stated.

Historical Chemistry: (*For Graduate Students*): Professor REMSEN. Daily, except Monday, 9 a. m. (36).

Allen, W. M.
Ballard, Z. M.
Berkeley, W. N.
Black, H. V.
Blanchard, W. M.
Brownlee, R. H.
Byers, H. G.
Canter, H.
Case, W. A.
Caspari, C. E.
Chamberlain, J. S.
Chambers, V. J.
Clark, F. E.
Douglas, J. M.
Fischer, J. S.
Fraps, G. S.
Frazer, J. C. W.
Garner, W. W.
Guenther, F.
Hancock, F. A.
Holmes, W. B.
Horn, D. W.
Humphreys, R. E.
King, S. H.
Knight, N.
Lawson, A. C.
Lindley, W. P.
Nakaseko, R.
Olsen, J. C.
Parsons, L. A.
Patterson, A. M.
Russell, G. W.
Turner, H. J.
Waters, C. E.
Wilson, F. D.
Winston, J. H. C.

Journal Meeting: Professor REMSEN. Monday, 9 a. m. (34). The instructors in Chemistry and the following students:

Allen, W. M.
Berkeley, W. N.
Black, H. V.
Blanchard, W. M.
Brownlee, R. H.
Byers, H. G.
Canter, H.
Case, W. A.
Caspari, C. E.
Chamberlain, J. S.
Chambers, V. J.
Clark, F. E.
Douglas, J. M.
Fischer, J. S.
Fraps, G. S.
Frazer, J. C. W.
Garner, W. W.
Guenther, F.
Hancock, F. A.
Holmes, W. B.
Horn, D. W.
Humphreys, R. E.
King, S. H.
Knight, N.
Lawson, A. C.
Lindley, W. P.
Nakaseko, R.
Olsen, J. C.
Patterson, A. M.
Russell, G. W.
Turner, H. J.
Waters, C. E.
Wilson, F. D.
Winston, J. H. C.

Physical Chemistry: Dr. H. C. JONES. Thursday and Fri 12 m. (12).

Allen, W. M.
Chamberlain, J. S.
Crawford, A. C.
Douglas, J. M.
Fraps, G. S.
King, S. H.
Lindley, W. P.
Meyer, J. F.
Palmer, E. L.
Parsons, L. A.
Potts, L. M.
Turner, H. J.

Inorganic Chemistry: (*Major Course*): Professor MORSE. Da except Monday, 9 a. m. (10).

Baldauf, L. K.
Bates, J. S.
Beck, G. C.
Foutz, C. R.
Glaser, O. C.
James, R.
Meyer, J. F.
Powell, M. W.
Rous, F. P.
Winslow, N.

General Chemistry: (*Minor Course*): Professor RENOUF and GILPIN. Daily, except Monday, 9 a. m., Hopkins Hall. (51).

Abercrombie, R. T.
Bandel, J. M.
Braun, J.
Bruton, A. W.
Bye, M.
Chatard, J. A.
Constantine, C. W.
Cronin, F. H.
Dapprich, F. R.
Davidson, G. D.
Diggs, C. F.
Eager, J. H.
Ewell, J. E.
Fooks, W. M.
Gemmill, J. R.
Greene, J. D.
Griffin, J. W.
Griffith, W. A.
Hatch, E. C.
Heyman, S.
Hill, H. D.
Hill, J. P.
James, W. McC.
Joyner, L. L.
Knapp, G. W.
Krager, W. M.
Kurrelmeyer, H.
Leopold, E. J.
Mackall, L. L.
Morse, R. B.
Mower, F. D.
Preston, J. O.
Rehberger, G. E.
Rehberger, J. M.
Riggins, J. A.
Roulston, R. B.
Shippen, L. P.
Shreve, O. F.
Smith, R. T.
Stein, J. S.
Straus, H. P.
Struth, O. A.
Swindell, W.
Taneyhill, G.
Vogeler, C. A.
Warner, H. M
West, A. P.
Wilkinson, A.
Wingert, M.
Wolf, M. W.
Zies, F.

Laboratory Work: Professor REMSEN, Professor MORSE, Profes RENOUF, Dr. GILPIN, Dr. H. C. JONES, Dr. REESE. Daily, 9 a. m. 5 p. m. (103).

Abercrombie, R. T.
Allen, W. M.
Baldauf, L. K.
Ballard, Z. M.
Bandel, J. M.
Bates, J. S.
Beck, G. C.
Berkeley, W. N.
Black, H. V.
Blanchard, W. M.
Braun, J.
Brownlee, R. H.
Bruton, A. W.
Bye, M.
Byers, H. G.
Canter, H.
Case, W. A.
Caspari, C. E.
Chamberlain, J. S.
Chambers, V. J.
Chatard, J. A.
Clark, F. E.
Constantine, C. W.
Cronin, F. H.
Dapprich, F. R.
Davidson, G. D.
Diggs, C. F.
Douglas, J. M.
Eager, J. H.
Ewell, J. E.
Fooks, W. M.
Fraps, G. S.
Frazer, J. C. W.
Fischer, J. S.
Flinn, F. B.
Foutz, C. R.
Garner, W. W.
Gemmill, J. R.
Glaser, O. C.
Greene, J. D.
Griffin, J. W.
Griffith, W. A.
Guenther, F.
Hancock, F. A.
Hatch, E. C.
Herrick, J. C.
Heyman, S.
Hill, H. D.
Hill, J. P.
Holmes, W. B.
Horn, D. W.
Humphreys, R. E.
James, R.
James, W. McC.
Joyner, L. L.
King, S. H.
Knapp, G. W.
Knight, N.
Krager, W. M.
Kurrelmeyer, H.
Lawson, A. C.
Leopold, E. J.
Lindley, W. P.
Mackall, L. L.
Meyer, J. F.
Morse, R. B.
Mower, F. D.
Nakaseko, R.
Nightingale, C. E.
Olsen, J. C.
Palmer, E. L.
Parsons, L. A.
Patterson, A. M.
Powell, M. W.
Preston, J. O.
Rehberger, G. E.
Rehberger, J. M.
Riggins, J. A.
Roulston, R. B
Rous, F. P.
Russell, G. W.
Seth, A. L.
Shippen, L. P.
Shreve, O. F.
Smith, R. T.
Stein, J. S.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Taneyhill, G. L
Turner, H. J.
Vogeler, C. A.
Warner, H. M.
Waters, C. E.
West, A. P.
Wilkinson, A. L
Wilson, F. D.
Wingert, M.
Winslow, N.
Winston, J. H.
Wolf, M. W.
Wright, A.
Zies, F.

Geology. (32 Students).

Classes meet in the Geological Laboratory.

General Geology: Professor CLARK and Dr. SHATTUCK. Lectur daily, except Friday, 1 p. m.; Laboratory work, Wednesday, 2–5 p. Excursions, Saturdays during the Autumn. (32).

Baetjer, H.
Bibbins, A.
Blanchard, W. M.
Bonsteel, J. A.
Brown, G. V.
Clark, F. E.
Cleaver, W. M.
Cragin, F. W.
Fassig, O. L.
Flinn, F. B.
Ford, C. E.
Garner, W. W.
Glenn, L. C.
Hancock, F. A.
Hindshaw, H. H.
Holmes, W. B.
Horn, D. W.
Humphreys, R. E.
Hyde, E. P.
Levering, J.
Martin, G. C.
McAll, R. L.
McLaughlin, A. C.
Patterson, A. M.
Remsen, C. M.
Rous, F. P.
Routh, J. E.
Rowe, R. B
Werber, O. S.
Wright, A.
Wright, F. B.
Wright, H. C.

Paleontology: Professor CLARK. Monday and Wednesday, 9 a. (11).

Bonsteel, J. A.
Brown, G. V.
Cleaver, W. M.
Cragin, F. W.
Curtis, W. C.
Hindshaw, H. H.
Martin, G. C.
McLaughlin, A. C.
Reese, A. M.
Rowe, R. B.
Wright, F. B.

Paleontology: (*Laboratory Work*): Professor CLARK and Dr. SHA TUCK. Wednesday and Thursday, 2–5 p. m. (12).

Bibbins, A.
Bonsteel, J. A.
Brown, G. V.
Cleaver, W. M.
Cragin, F. W.
Curtis, W. C.
Glenn, L. C.
Hindshaw, H. H.
Martin, G. C.
McLaughlin, A.
Rowe, R. B.
Wright, F. B.

Experimental Geology: Associate Professor REID. Tuesday a Thursday, 9 a. m. (7).

Bonsteel, J. A.
Brown, G. V.
Cleaver, W. M.
Martin, G. C.
McLaughlin, A. C.
Rowe, R. B.
Wright, F. B.

Petrography: Dr. MATHEWS.

Lectures: Monday, Tuesday, Wednesday, 11 a. m. (9).

Bonsteel, J. A.
Brown, G. V.
Cleaver, W. M.
Cragin, F. W.
Glenn, L. C.
Hindshaw, H. H.
Martin, G. C.
Rowe, R. B.
Wright, F. B.

Laboratory Work: Monday and Tuesday, 2–5 p. m., Wednesday, Thu day, Friday, 9 a. m. to 5 p. m. (10).

Brown, G. V.
Cleaver, W. M.
Cragin, F. W.
Fassig, O. L.
Glenn, L. C.
Hindshaw, H. H.
McLaughlin, A. C.
Martin, G. C.
Rowe, R. B.
Wright, F. B.

Climatology: Mr. Fassig. Thursday and Friday, 11 a. m. (5). (Twenty lectures).

Bonsteel, J. A.
Clark, F. E.
Cleaver, W. M.
McLaughlin, A. C.
Wright, F. B.

Journal Meeting: Professor Clark, Associate Professor Reid, Dr. Mathews. Friday, 9 a. m. (13).

Bibbins, A.
Bonsteel, J. A.
Brown, G. V.
Cleaver, W. M.
Cragin, F. W.
Fassig, O. L.
Glenn, L. C.
Hindshaw, H. H.
Martin, G. C.
McLaughlin, A. C.
Rowe, R. B.
Shattuck, G. B.
Wright, F. B.

Biology. (113 Students).

Classes meet in the Biological Laboratory.

Advanced Zoology: Professor Brooks. Daily, 10 a. m. to 5 p. m. (12).

Berger, E. W.
Coker, W. C.
Cragin, F. W.
Curtis, W. C.
Drew, G. A.
Grave. C.
Griffin, L. E.
Knower, H. M.
Perkins, H. F.
Reese, A. M.
Stein, L. D.
Sudler, M. T.

Zoological Journal Club: Professor Brooks, Associate Professor Andrews, Dr. Barton. Monday, 11 a. m. (13).

Berger, E. W.
Coker, W. C.
Curtis, W. C.
Drew, G. A.
Grave, C.
Griffin, L. E.
Johnson, D. S.
Knower, H. M.
Metcalf, M. M.
Perkins, H. F.
Reese, A. M.
Stein, L. D.
Sudler, M. T.

Zoology: (*Undergraduate Elective*): Professor Brooks. Tuesday, 2–4 p. m. (4).

Flinn, F. B.
Jungbluth, K.
Levering, J.
Taveau, R.

Zoology: (*Major Course*): Professor Brooks. Daily, except Monday, 9 a. m.; Monday and Tuesday, 2–5 p. m. (4).

Anderson, R. B. T.
Jungbluth, M.
McAll, R. L.
Thomas, R. H.

Physiological Seminary: Professor Howell. Monday, 10 a. m. (8).

Canter, H.
Curtis, W. C.
Dawson, P. M.
Griffin, L. E.
Herrick, J. C.
Nakaseko, R.
Stein, L. D.
Walden, E. C.

Physiological Journal Club: Professor Howell. Monday, 9 a. m. (5).

Dawson, P. M.
Dreyer, G. P.
Herrick, J. C.
Hunt, R.
Walden, E. C.

Animal Physiology: Professor Howell. Wednesday, Thursday, Friday, 12 m. (66).

Graduate Students.

Canter, H.
Curtis, W. C.
Griffin, L. E.
Herrick, J. C.
Nakaseko, R.
Stein, L. D.
Walden, E. C.

Medical Students (2d Year).

Atherton, A. M.
Baetjer, F. H.
Baldwin, W. D.
Berry, J. M.
Blakeslee, W. H.
Bloombergh, H. D.
Boggs, T. R.
Bosley, J. R.
Bunting, C. H.
Butler, J. I.
Carey, H. W.
Chowning, W. M.
Comer, R. T.
Connor, G. L.
Connor, R.
Drake, G. S.
Dutcher, A.
Fowler, H. A.
Gay, F. P.
Graham, N. D.
Hall, G. W.
Hamman, L. V.
Hastreiter, R. F.
Hathaway, J. H.
Hitzrot, J. M.
Holden, G. R.
Hume, E. H.
Johnston, W. B.
Kaufman, H. M.
Kimball, A. H.
Lamson, T.
Lewis, D. M.
Long, M.
Longcope, W. T.
Lyle, A. G.
Maddren, W. H.
McKeough, E. P.
Moore, E. S.
Parker, H. P.
Pullen, F. K.
Rubel, M. J.
Rushmore, S.
Salter, J. C.
Simis, M. P.
Slemons, J. M.
Smith, H. M.
Spratt, C. N.
Stein, G.
Steinfeld, A. L.
Swett, C. M.
Ulrich, H. L.
Underhill, A. J.
Walker, M. B.
Warfield, L. M.
Warren, G. W.
Watts, S. H.
Wells, E. A.
Wells, M.
Winne, C. K.

General Biology: (*Minor Course*): Associate Professor Andrews. Thursday and Friday, 10 a. m., 2–5 p. m. (28).

Abercrombie, R. T.
Bates, J. S.
Breed, A. A.
Briscoe, J. S.
Chatard, J. A.
Fischer, J. S.
Frank, S. W.
Fraps, G. S.
Glaser, O. C.
Greenbaum, H. S.
Guggenheimer, C. M.
Hanna, H. S.
Haskell, L. W.
Hollander, L. M.
Keidel, A.
Mackall, L. L.
Manken, H.
McAll, R. L.
Morgan, P. S.
Noble, E. R.
Perkins, H. F.
Reymann, L. A.
Robinson, G. C.
Rous, F. P.
Spencer, L. C.
Tondorf, F. A.
Werber, O. S.
Wilkinson, A. L.

Osteology: (*Minor Course*): Associate Professor Andrews. Monday and Wednesday, 10 a. m. (26).

Abercrombie, R. T.
Bates, J. S.
Breed, A. A.
Briscoe, J. S.
Chatard, J. A.
Fischer, J. S.
Frank, S. W.
Glaser, O. C.
Greenbaum, H. S.
Guggenheimer, C. M.
Hanna, H. S.
Haskell, L. W.
Hollander, L. M.
Keidel, A.
Mackall, L. L.
Manken, H.
McAll, R. L.
Morgan, P. S.
Noble, E. R.
Reymann, L. A.
Robinson, G. C.
Rous, F. P.
Spencer, L. C.
Tondorf, F. A.
Werber, O. S.
Wilkinson, A. L.

Botany: (*For Graduates*): Dr. D. S. Johnson. Monday and Tuesday, 10 a. m.; Thursday and Friday, 10 a. m., 2–5 p. m. (3).

Chambers, V. J.
Coker, W. C.
Griffin, L. E.

Laboratory Work: Professor Brooks, Professor Howell, Associate Professor Andrews, Dr. Dreyer, Dr. Johnson, Dr. Drew. Daily, 9 a. m. to 5 p. m. (111).

Abercrombie, R. T.
Anderson, R. B. T.
Atherton, A. M.
Baetjer, F. H.
Baldwin, W. D.
Bates, J. S.
Berger, E. W.
Berry, J. M.
Blakeslee, W. H.
Bloombergh, H. D.
Boggs, T. R.
Bosley, J. R.
Breed, A. A.
Briscoe, J. S.
Bunting, C. H.
Butler, J. I.
Canter, H.
Carey, H. W.
Chambers, V. J.
Chatard, J. A.
Chowning, W. M.
Coker, W. C.
Comer, R. T.
Connor, G. L.
Connor, R.
Cragin, F. W.
Curtis, W. C.
Dawson, P. M.
Drake, G. S.
Dutcher, A.
Fischer, J. S.
Flinn, F. B.
Fowler, H. A.
Frank, S. W.
Gay, F. P.
Glaser, O. C.
Graham, N. D.
Grave, C.
Greenbaum, H. S.
Griffin, L. E.
Guggenheimer, C. M.
Hall, G. W.
Hamman, L. V.
Hanna, H. S.
Haskell, L. W.
Hastreiter, R. F.
Hathaway, J. H.
Herrick, J. C.
Hitzrot, J. M.
Holden, G. R.
Hollander, L. M.
Hume, E. H.
Johnston, W. B.
Jungbluth, K.
Jungbluth, M.
Kaufman, H. M.
Keidel, A.
Kimball, A. H.
Knower, H. M.
Lamson, T.
Levering, J.
Lewis, D. M.
Long, M.
Longcope, W. T.
Lyle, A. G.
Mackall, L. L.
Maddren, W. H.
Manken, H.
McAll, R. L.
McKeough, E. P.
Moore, E. S.
Morgan, P. S.
Nakaseko, R.
Noble, E. R.
Palmer, E. L.
Parker, H. P.
Perkins, H. F.
Pullen, F. K.
Reese, A. M.
Reymann, L. A.
Rich, H. L.
Robinson, G. C.
Rous, F. P.
Rubel, M. J.
Rushmore, S.
Salter, J. C.
Simis, M. P.
Slemons, J. M.
Smith, H. M.
Spencer, L. C.
Spratt, C. N.
Stein, G.
Stein, L. D.
Steinfeld, A. L.
Sudler, M. T.
Swett, C. M.
Taveau, R.
Thomas, R. H.
Tondorf, F. A.
Ulrich, H. L.
Underhill, A. J.
Walden, E. C.
Walker, M. B.
Warfield, L. M.
Warren, G. W.
Watts, S. H.
Wells, E. A.
Wells, M.
Werber, O. S.
Wilkinson, A. L.
Winne, C. K.

Greek. (46 Students).

Classes meet in McCoy Hall.

Greek Seminary: *Aristophanes:* Professor Gildersleeve. Monday and Wednesday, 10 a. m., Room 14. (16).

Archibald, H. T.
Beardsley, W. F.
Blackwell, I. H.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Practical Exercises: Professor Gildersleeve. Tuesday and Friday, 10 a. m., Room 14. (17).

Archibald, H. T.
Beardsley, W. F.
Blackwell, I. H.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Montgomery, W. A.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Greek Syntax: Professor Gildersleeve. Thursday, 10 a. m., Room 14. (20).

Archibald, H. T.
Baden, W. W.
Beardsley, W. F.
Blackwell, I. H.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Montgomery, W. A.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. A.
Smith, C. S.
Sparks, C. B.

Aristophanes: Associate Professor Miller. Tuesday and Thursday, 9 a. m., Room 15. (15).

Archibald, H. T.
Beardsley, W. F.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Montgomery, W. A.
Pyle, T. L.
Ragland, G.
Savage, C. A.

Classical Archaeology: Dr. Carroll.

The Acropolis: Thursday, 3 p. m., Room 15. (17).

Anderson, R. B. T.
Archibald, H. T.
Basore, J. W.
Bogue, H.
Burrell, J. L. A.
Foote, T. C.
Foushee, W. L.
Griffin, J. W.
Guernsey, R.
Hamilton, H. A.
Mackall, L. L.
McWhorter, A. W.
Milden, A. W.
Purcell, T. N. D.
Pyle, T. L.
Ragland, G.
Smith, C. S.

The Topography of Athens: Friday, 12 m., Room 19. (11).

Archibald, H. T.
Basore, J. W.
Foote, T. C.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Mackall, L. L.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.

Lucian, *Vera Historia;* ***Letter of James:*** (*Undergraduate Elective*): Associate Professor Spieker. Tuesday, 10 a. m., Thursday, 9 a. m., Room 10. (3).

Fisher, F. C.
Ross, W. L.
Spilman, E. A.

Plato, *Protagoras:* (*Major Course*): Associate Professor Spieker. Monday, Tuesday, Wednesday, 12 m., Room 10. (9).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Purcell, T. N. D.
Shriver, W. P.
Sparks, C. B.
Wight, C.

Xenophon, *Oeconomicus:* (*Minor Course*): Associate Professor Spieker. Tuesday, Wednesday, Thursday, 1 p. m., Room 10. (10).

Blackwell, I. H.
Booker, J. M.
Briscoe, J. S.
Fishach, L. G.
Machen, J. G.
Manken, H.
Noble, E. R.
Powers, H. W. S.
Snavely, G. E.
Spencer, L. C.

Homer, *Iliad*, book vi; ***Prose Composition:*** Associate Professor Miller. Monday, 10 a. m., Thursday and Friday, 1 p. m., Room 8. (3).

Fenwick, B. L.
Mower, McH.
Stephens, J. L.

Prose Composition: Associate Professor SPIEKER.

Major Course: Friday, 12 m., Room 10. (9).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Purcell, T. N. D.
Shriver, W. P.
Sparks, C. B.
Wight, C.

Minor Course: Monday, 1 p. m., Room 10. (10).

Blackwell, I. H.
Booker, J. M.
Briscoe, J. S.
Fishach, L. G.
Machen, J. G.
Manken, H.
Noble, E. R.
Powers, H. W. S.
Snavely, G. E.
Spencer, L. C.

Latin. (67 Students).

Classes meet in McCoy Hall.

Latin Seminary: *Cicero:* Professor WARREN. Tuesday and Friday, 11 a. m., Room 15. (19).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Griffith, G.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Roman Oratory: Professor WARREN. Monday, 11 a. m., Room 15. (19).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Griffith, G.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Incertus Auctor ad Herennium: Professor WARREN. Wednesday, 11 a. m., Room 15. (15).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Griffith, G.
Guernsey, R.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Journal Club: Professor WARREN. Tuesday, 12 m., Room 15. (17).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Griffith, G.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Practical Exercises: Associate Professor SMITH. Thursday, 11 a. m. Room 15. (18).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Griffith, G.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Juvenal: (*Major Course*): Associate Professor SMITH. Wednesday, Thursday, and Friday, 10 a. m, Room 10. (9).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Leigh, J. E.
Purcell, T. N. D.
Roulston, R. B.
Wight, C.

Roman Literature: (*Minor Course*): Associate Professor SMITH. Tuesdays, 9 a. m., Room 11. (18).

Bernheim, B. M.
Bird, A. R.
Boyer, N.
Brady, J. H.
Brown, E. B.
Byrne, H. S.
Duck, R. S.
Griffin, E. J.
Harris, W. H.
Hollander, L. M.
Kohn, W.
Lowndes, E.
Norton, E. L.
Raffel, H. B.
Sayler, J. A.
Turnbull, B.
Tyler, J. E.
Whitman, H. S.

Livy: (*Minor Course*): Dr. H. L. WILSON. Wednesday, Thursday, and Friday, 9 a. m., Room 12. (29).

Bernheim, B. M.
Bird, A. R.
Booker, J. M.
Boyer, N.
Brady, J. H.
Briscoe, J. S.
Brown, E. B.
Byrne, H. S.
Duck, R. S.
Fishach, L. G.
Griffin, E. J.
Harris, W. H.
Hollander, L. M.
Kohn, W.
Leigh, J. E.
Lowndes, E.
Machen, J. G.
Manken, H.
Miller, H. C.
Noble, E. R.
Norton, E. L.
Powers, H. W. S.
Raffel, H. B.
Sayler, J. A.
Snavely, G. E.
Spencer, L. C.
Turnbull, B.
Tyler, J. E.
Whitman, H. S.

Cicero's Letters; Sallust; Prose Composition; Dr. H. L. WILSON. Wednesday, Thursday, and Friday, 10 a. m., Room 8. (11).

Cook, T. G.
Dapprich, F. R.
Fenwick, B. L.
Hazen, H. H.
Hill, W. B.
Lilly, W. L.
Lisberger, S. J.
Mower, McH.
Reeves, E. D.
Stephens, J. L.
Strouse, E.

Prose Composition:

Major Course: Associate Professor SMITH. Monday, 10 a. m, Room 10. (9).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Leigh, J. E.
Purcell, T. N. D.
Roulston, R. B.
Wight, C.

Minor Course: Dr. H. L. WILSON. Tuesday, 9 a. m, Room 12. (11).

Booker, J. M.
Briscoe, J. S.
Fishach, L. G.
Leigh, J. E.
Machen, J. G.
Manken, H.
Miller, H. C.
Noble, E. R.
Powers, H. W. S.
Snavely, G. E.
Spencer, L. C.

Sanskrit and Comparative Philology. (31 Studen

Classes meet in McCoy Hall, Room 19.

Comparative Philology: Professor BLOOMFIELD. Monday, 4 p. (15).

Beardsley, W. F.
Bogue, H.
Chambers, L. M.
Fisher, F. C.
Fowler, T. H.
French, J. C.
Guernsey, R.
Harwood, S. P.
King, J. H.
McWhorter, A. W.
Ragland, G.
Ross, W. L.
Smith, C. S.
Spilman, E. A.
Weber, W. L.

Elements of Phonetics: Professor BLOOMFIELD. Wednesday, 12 (15).

Archibald, H. T.
Blake, F. R.
Foster, H. B.
Griffin, N. E.
Grimm, K. J.
Hagen, S. N.
Hamilton, H. A.
Kurrelmeyer, W.
McWhorter, A. W.
Milden, A. W.
Ness, J. A.
Pyle, T. L.
Savage, C. A.
Smith, C. A.
Smith, C. S.

Comparative Grammar: *Indo-European Vocalism:* Professor BLOOMFIELD. Thursday, 4 p. m. (10).

Blake, F. R.
Foote, T. C.
Guernsey, R.
Hamilton, H. A.
Kurrelmeyer, W.
McWhorter, A. W.
Milden, A. W.
Ness, J. A.
Pyle, T. L.
Smith, C. S.

Lithuanian Language and Literature: Professor BLOOMFIEl Tuesday, 12 m. (3).

Blake, F. R.
Kurrelmeyer. W.
Ness, J. A.

Vedic Seminary: *The Hymns of the Rig-Veda:* Professor BLOOMFIEl Friday, 4 p. m. (3).

Blake, F. R.
Foster, H. B.
Ness, J. A.

Interpretation of the Drama Çakuntala: Professor BLOOMFIELD. Wednesday, 4 p. m. (4).

Blake, F. R.
Foster, H. B.
Kurrelmeyer, W.
Ness, J. A.

Readings from the Hitopadeça: Mr. BLAKE. Thursday, 3 p. (3).

Foster, H. B.
Kurrelmeyer, W.
Savage, C. A.

Elementary Sanskrit: Professor BLOOMFIELD. Monday and Thu day, 12 m. (12).

Archibald, H. T.
Beardsley, W. F.
Blackwell, I. H.
Fowler, T. H.
Guernsey, R.
Kurrelmeyer, H.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. A.
Smith, C. S.

Oriental Seminary. (26 Students).

Classes meet in the Dillmann Library, McCoy Hall, Room 18.

History of Egypt: Dr. JOHNSTON. Friday, 10 a. m. (17).

Blake, F. R.
Brander, W. W.
Briscoe, J. S.
Drewry, W. S.
Ewing, J. R.
Grimm, K. J.
Groome, P. L.
Guttmacher, A.
McPherson, W. B.
Motley, D. E.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Sioussat, St. G.
Sommerville, C.
Sumwalt, J. W.
Thom, W. T.

Elementary Hebrew: (*Gesenius-Kautzsch's Hebrew Grammar, tra lated by Collins and Cowley; Genesis, ed. Baer-Delitzsch*): Profes HAUPT. Wednesday, 3–5 p. m. (8).

Foote, T. C.
Grimm, K. J.
Guttmacher, A.
Jones, J. W.
McPherson, W. B.
Schanfarber, T.
Sparks, C. B.
Sumwalt, J. W.

Hebrew: (*Second Year's Course: Interpretation of the Book of Genes* Professor Haupt. Monday, 3 p. m. (10).

Blake, F. R.
Caldwell, W.
Foote, T. C.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Rosenau, W.
Schanfarber, T.
Sparks, C. B.
Sumwalt, J. W.

Exercises in Reading Hebrew at Sight: (*Historical Book* Dr. JOHNSTON. Friday, 11 a. m. (3).

Blake, F. R.
McPherson, W. B.
Sparks, C. B.

Hebrew Prose Composition: (*Translating from English into Hebre* Professor HAUPT. Tuesday, 3.30 p. m. (8).

Blake, F. R.
Caldwell, W.
Foote, T. C.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Sparks, C. B.
Sumwalt, J. W.

Comparative Semitic Grammar: Professor HAUPT. Mond 4 p. m. (9).

Blake, F. R.
Caldwell, W.
Foote, T. C.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Rosenau, W.
Schanfarber, A.
Sparks, C. B.

Hebrew: (*Advanced Course: Critical Interpretation of the Book of Job* Professor HAUPT. Monday, 5 p. m. (10).

Blake, F. R.
Caldwell, W.
Foote, T. C.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Rosenau, W.
Schanfarber, T.
Sparks, C. B.
Sumwalt, J. W.

Biblical Aramaic: (*Interpretation of the Aramaic Portions of the Bo of Ezra*): Professor HAUPT. Tuesday, 4 p. m. (5).

Blake, F. R.
Caldwell, W.
Grimm, K. J.
McPherson, W. B.
Sparks, C. B.

Syriac: (*Chronicles of Bar Ebrâyâ*): Dr. JOHNSTON. Wednesday, 10 a.m.

Grimm, K. J.
Sparks, C. B.

Arabic for Beginners: (*Socin's Grammar*): Dr. JOHNSTON. Frid 3 p. m. (3).

Batchelder, J. D.
Gould, W. E.
Mosemiller, C. A.

Arabic: (*Second Year's Course: Brünnow's Chrestomathy*): Dr. JOHNSTON. Tuesday, 11 a. m. (1).

McPherson, W. B.

Selected Suras of the Koran: Dr. JOHNSTON. Wednesday, 11 a. m. (3).

Blake, F. R.
Grimm, K. J.
Sparks, C. B.

Arabic Prose Composition: (*Translating from English into Arabic*): Professor HAUPT. Tuesday, 3 p. m. (7).

Blake, F. R.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Rosenau, W.
Schanfarber, T.
Sparks, C. B.

Assyrian: (*Second Year's Course: Meissner's Chrestomathy*): Dr. JOHNSTON. Tuesday, 12 m. (2).

McPherson, W. B.
Sparks, C. B.

Epistolary Literature of the Assyrians and Babylonians: Dr. JOHNSTON. Wednesday, 9 a. m. (1).

Grimm, K. J.

Assyrian Seminary: Professor HAUPT. Tuesday, 5 p. m. (3).

Blake, F. R.
Grimm, K. J.
Sparks, C. B.

Sumerian: Professor HAUPT. Wednesday, 5 p. m. (3).

Blake, F. R.
Grimm, K. J.
Sparks, C. B.

English. (141 Students).

Classes meet in McCoy Hall.

English Seminary: (*The English Drama before Shakespeare*): Professor BRIGHT. Tuesday and Thursday, 3-5 p. m., Room 4. (13).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Griffin, N. E.
Hagen, S. N.
Huguenin, J.
Miles, L. W.
Parham, D. P.
Schneider, J. P.
Weber, W. L.
West, H. S.
Wharey, J. B.

Historical English Grammar: (*Lectures*): Professor BRIGHT. Tuesday, 12 m., Wednesday, 4 p. m., Room 12. (15).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Fowler, T. H.
Griffin, N. E.
Griffith, G.
Hagen, S. N.
Huguenin, J.
Miles, L. W.
Parham, D. P.
Schneider, J. P.
Weber, W. L.
West, H. S.
Wharey, J. B.

The Poems of Shakespeare: Professor BRIGHT. Thursday, 12 m., Room 12. (15).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Griffin, N. E.
Griffith, G.
Hagen, S. N.
Hood, F.
Huguenin, J.
Miles, L. W.
Parham, D. P.
Schneider, J. P.
Weber, W. L.
West, H. S.
Wharey, J. B.

Journal Meeting: Professor BRIGHT. Alternate Fridays, 4-6 p. m., Room 4. (16).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Griffin, N. E.
Griffith, G.
Hagen, S. N.
Hood, F.
Huguenin, J.
Miles, L. W.
Parham, D. P.
Smith, C. A.
Schneider, J. P.
Weber, W. L.
West, H. S.
Wharey, J. B.

Anglo-Saxon: (*Major Course*): Professor BRIGHT. Monday and Wednesday, 12 m., Room 8. (3).

Fosnocht, E. B.
Hood, F.
Schneider, J. P.

The Caroline Poets: (*For Graduates*): Professor BROWNE. Wednesday, 11 a. m., Room 8. (14).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Fowler, T. H.
Griffin, N. E.
Hagen, S. N.
Hood, F.
Huguenin, J.
Miles, L. W.
Miller, R. D.
Parham, D. P.
West, H. S.
Wharey, J. B.

Elizabethan Literature; Early Scottish Poets: (*Major Course*): Professor BROWNE. Tuesdays and Fridays, 12 m., Room 8. (2).

Fosnocht, E. B.
Hood, F.

Early English Texts: English Literature: (*Minor Course*): Professor BROWNE. Daily, except Friday, 1 p. m., Room 6. (10).

Ember, A.
Gaddess, C. C.
Gemmill, J. R.
Haskell, L. W.
Hood, F.
Morgan, P. S.
Robinson, E. A.
Robinson, G. C.
Smull, M. N.
Wight, C.

English Literature: (*Undergraduate Elective*): Professor GREENE. Thursday, 12 m., Friday, 1 p. m., Room 9. (12).

Bogue, H.
Chambers, L. M.
Clarke, G. M.
Ensor, J. T.
Fisher, F. C.
Frank, S. W.
French, J. C.
Grimes, R. H.
Guthrie, C. E.
King, J. H.
Leigh, J. E.
Murkland, P. A.

English Literature: (*Required Undergraduate Course*): Professor GREENE. Monday, 9 a. m., Tuesday. 10 a. m., Wednesday, 11 a. m., Room 11. (44).

Anderson, R. B. T.
Baetjer, H.
Beeuwkes, C. J.
Bernheim, B. M.
Bouchelle, B. N.
Breed, A. A.
Brooks, C. E.
Burrell, J. L. A.
Clark, C. T.
De Grange, M.
Eager, J. H.
Ewell, J. E.
Ford, C. E.
Foster, F.
Francis, I. H.
Glaser, O. C.
Grasty, J. S.
Greene, J. D.
Heyman, S.
Hill, J. P.
Homer, H. L.
Hyde, E. P.
Jones, J. W.
Kerr, R. C.
Liddell, D. M.
Lindheim, N. R.
Mackall, L. L.
Marshall, T. H.
McAll, R. L.
Moore, J. S.
Powell, M. W.
Purcell, T. N. D.
Roulston, R. B.
Rous, F. P.
Schermerhorn, A. V. R.
Shriver, W. P.
Smith, W. L.
Spencer, E. M.
Stephens, C. G.
Taneyhill, G. L.
Wingert, M.
Winslow, N.
Wirt, C. B.
Wright, A.

Rhetoric and English Composition: Professor GREENE. Monday, Tuesday, Wednesday, 12 m., Room 11. (63).

Baldauf, L. K.
Bandel, J. M.
Bird, A. R.
Booker, J. M.
Boyer, N.
Braun, J.
Briscoe, J. S.
Brown, E. B.
Bruton, A. W.
Bye, M.
Byrne, H. S.
Constantine, C. W.
Cook, T. G.
Cronin, F. H.
Dapprich, F. R.
Diggs, C. F.
Duck, R. S.
Ember, A.
Fishach, L. G.
Ford, C. E.
Grasty, J. S.
Griffith, W. A.
Hatch, E. C.
Hollander, L. M.
James, W. McC.
Jones, J. W.
Leopold, E. J.
Lilly, W. L.
Lisberger, S. J.
Lowndes, E.
Machen, J. G.
Manken, H.
Maury, R. M.
Miller, H. C.
Morse, R. B.
Mower, F. D.
Noble, E. R.
Norton, E. L.
Powers, H. W. S.
Raffel, H. B.
Reeves, E. D.
Rehberger, G. E.
Riggins, J. A.
Sayler, J. A.
Shippen, L. P.
Shreve, O. F.
Smith, R. T.
Snavely, G. E.
Spencer, E. M.
Spencer, L. C.
Stein, J. S.
Straus, H. P.
Strouse, E.
Struth, O. A.
Swindell, W. B.
Turnbull, B.
Tyler, J. E.
Vogeler, C. A.
Warner, H. M.
West, A. P.
Whitman, H. S.
Wolf, M. W.
Zies, F.

German. (122 Students).

Classes meet in McCoy Hall.

Advanced Courses.

German Seminary: "*Sturm und Drang*" *and Early Romanticism*: Professor WOOD. Tuesday, Thursday, Friday, 9 a. m., Room 4. (12).

Farr, J. M.
Fowler, T. H.
Glascock, C. C.
Hagen, S. N.
Hicks, F. C.
Hofmann, J.
Hullihen, W.
Kurrelmeyer, W.
Lyon, C. E.
Miles, L. W.
Schneider, J. P.
Stidman, A. G.

Germanic Society: Professor WOOD. Fortnightly, Friday, 4-6 p. m., Room 4. (16).

Blake, F. R.
Butler, P.
Farr, J. M.
Fowler, T. H.
Glascock, C. C.
Hagen, S. N.
Hicks, F. C.
Hofmann, J.
Hullihen, W.
Kurrelmeyer, W.
Lyon, C. E.
Miles, L. W.
Ness, J. A.
Schneider, J. P.
Stidman, A. G.
Wilkens, F. H.

Gothic: Professor WOOD. Wednesday and Friday, 10 a. m., Room 4. (7).

Farr, J. M.
Fowler, T. H.
Hicks, F. C.
Lyon, C. E.
Miles, L. W.
Ness, J. A.
Schneider, J. P.

Old Norse: Professor WOOD. Friday, 12 m., Room 4. (11).

Blake, F. R.
Butler, P.
Farr, J. M.
Glascock, C. C.
Griffin, N. E.
Hofmann, J.
Huguenin, J.
Kurrelmeyer, W.
Lyon, C. E.
Schneider, J. P.
Smith, C. A.

Old High German: *Otfrid*: Professor WOOD. Wednesday, 9 a. m., Room 4. (11).

Blake, F. R.
Brown, G. D.
Farr, J. M.
Fowler, T. H.
Glascock, C. C.
Hagen, S. N.
Hicks, F. C.
Hofmann, J.
Kurrelmeyer, W.
Lyon, C. E.
Schneider, J. P.

Middle High German: Associate Professor VOS. Monday, 9 a. m., Friday, 3 p. m., Room 6. (6).

Fosnocht, E. B.
Fowler, T. H.
Miles, L. W.
Parham, D. P.
Schneider, J. P.
Stidman, A. G.

Middle Dutch: Associate Professor VOS. Tuesday and Thursday, 10 a. m., Room 6. (4).

Blake, F. R.
Hicks, F. C.
Hofmann, J.
Kurrelmeyer, W.

Contemporary German Drama: Dr. BAKER. Monday, 1 p. m., Room 8. (5).

Foster, H. B.
Hicks, F. C.
Lyon, C. E.
Schneider, J. P.
Stidman, A. G.

Major Course.

History of German Literature: Associate Professor VOS. Monday; ***Goethe,*** *Faust*: Professor WOOD. Tuesday and Friday; ***Prose Composition:*** Professor WOOD and Mr. HOFMANN. Thursday, 11 a. m., Room 6. (18).

Bouchelle, B. N.
Braun, J.
Breed, A. A.
Ember, A.
Glaser, O. C.
Greene, J. D.
Griffin, J. W.
Hollander, L. M.
Leopold, E. J.
Mackall, L. L.
Miller, H. C.
Morse, R. B.
Roulston, R. B.
Taneyhill, G. L.
Turnbull, B.
Vogeler, C. A.
Wight, C.
Winslow, N.

Minor Course A.

Prose Composition: Professor WOOD. Monday; ***Prose Readings and Classics:*** Associate Professor VOS. Tuesday, Thursday, Friday, 11 a. m., Room 11. (40).

Abercrombie, R. T.
Baldauf, L. K.
Bandel, J. M.
Bernheim, B. M.
Bird, A. R.
Boyer, N.
Brown, E. B.
Bruton, A. W.
Bye, M.
Byrne, H. S.
Constantine, C. W.
Cook, T. G.
Diggs, C. F.
Fishach, L. G.
Griffin, E. J.
Griffith, W. A.
Harris, W. H.
Hatch, E. C.
Hazen, H. H.
James, W. McC.
Kohn, W. I.
Lilly, W. L.
Lowndes, E.
Norton, E. L.
Preston, J. O.
Reeves, E. D.
Rehberger, G. E.
Rehberger, J. M.
Riggins, J. A.
Sayler, J. A.
Shippen, L. P.
Shreve, O. F.
Smith, R. T.
Strouse, E.
Struth, O. A.
Swindell, W. B.
Tyler, J. E.
West, A. P.
Whitman, H. S.
Wolf, M. W.

Minor Course B.

Otis, *Elementary German*; ***Brandt,*** *German Reader*: Dr. BAKER. Daily, except Wednesday, 11 a. m., Room 8. (8).

Beck, G. C.
Burrell, J. L. A.
Chatard, J. A.
Hood, F.
Liddell, D. M.
Mower, F. D.
Powers, H. W. S.
Purcell, T. N. D.

Elementary German: Associate Professor Vos. Tuesday, Wednesday, Friday, 9 a. m., Room 6. (9).

Fenwick, B. L.
Gould, W. E.
Griffith, W. A.
Hill, W. B.
Lisberger, S. J.
Marston, O. C.
Maury, R. M.
Mower, McH.
Weaver, C. C.

Elective Courses.

Readings in Contemporary German Literature: *Sudermann, Die Schmetterlingsschlacht; Ebner-Eschenbach, Miterlebtes:* Dr. Baker. Monday, 9 a. m., Tuesday, 10 a. m., Room 8. (4).

Jungbluth, K.
Kalb, J. A.
Morgan, P. S.
Smull, M. N.

Scientific Readings: *Brandt and Day, German Scientific Readings:* Dr. Baker. Tuesday, 9 a. m., Room 20; Thursday, 12 m., Room 8. (6).

Bates, J. S.
Greenbaum, H. S.
Haskell, L. W.
Keidel, A.
Lazenby, M.
Robinson, G. C.

Special Courses.

Historical German: (*For Graduate Students*): Mr. W. Kurrelmeyer. Tuesday and Thursday, 5 p. m., Room 6. (9).

Beardsley, W. F.
Foote, T. C.
Groome, P. L.
Guernsey, R.
Haywood, R. W.
McWhorter, A. W.
Myers, W. S.
Pyle, T. L.
Smith, C. S.

Scientific German: *Dippold, Scientific German Reader:* (*For Graduate Students*): Mr. Hofmann. Monday and Thursday, 5 p. m., Room 8. (8).

Brownlee, R. H.
Coble, A. B.
Coker, W. C.
Douglas, J. M.
Horn, D. W.
Humphreys, R. E.
Loving, R. E.
Meyer, J. F.

Oral Exercises: Mr. Hofmann. Tuesday, 5 p. m., Room 8. (5).

Fosnocht, E. B.
Fowler, T. H.
Lyon, C. E.
Miles, L. W.
Stidman, A. G.

Romance Languages. (85 Students).

Classes meet in McCoy Hall.

Advanced Courses.

Romance Seminary: Professor Elliott. Tuesday, 11 a. m. to 1 p. m., Room 2. (7).

Batchelder, J. D.
Frein, P. J.
Gould, W. E.
Mosemiller, C. A.
Nitze, W. A.
Shaw, J. E.
Stidman, A. G.

French Dialects: Professor Elliott. Monday, 11 a. m., Room 2. (5).

Batchelder, J. D.
Frein, P. J.
Gould, W. E.
Mosemiller, C. A.
Shaw, J. E.

French Phonology: Dr. Armstrong. Monday, Tuesday, Thursday, 10 a. m., Room 2. (12).

Batchelder, J. D.
Canter, H. V.
Farr, J. M.
Frein, P. J.
Glascock, C. C.
Gould, W. E.
Lyon, C. E.
Mosemiller, C. A.
Shaw, J. E.
Stidman, A. G.
Teillard, X.
Wharey, J. B.

French Physiological Phonetics: Dr. Armstrong. Monday, 9 a. m., Room 2. (7).

Batchelder, J. D.
Brown, G. D.
Canter, H. V.
Gould, W. E.
Griffin, N. E.
Hicks, F. C.
Mosemiller, C. A.

Old French Readings: Dr. R. H. Wilson. Monday and Wednesday, 3 p. m., Room 2. (9).

Batchelder, J. D.
Brown, G. D.
Canter, H. V.
Gould, W. E.
Hicks, F. C.
Lyon, C. E.
Miles, L. W.
Miller, R. D.
Stidman, A. G.

Historical French Syntax: Dr. R. H. Wilson. Tuesday and Thursday, 3 p. m., Room 2. (5).

Batchelder, J. D.
Frein, P. J.
Mosemiller, C. A.
Nitze, W. A.
Shaw, J. E.

The French Novel (XIX Century): Dr. Ogden. Friday, 11 a. m., Room 2. (11).

Batchelder, J. D.
Brown, G. D.
Frein, P. J.
Hagen, S. N.
Hicks, F. C.
Miles, L. W.
Mosemiller, C. A.
Nitze, W. A.
Parham, D. P.
Shaw, J. E.
Stidman, A. G.

French Conversation: Mr. Teillard. Thursday, 4 p. m., Room 2. (7).

Batchelder, J. D.
Bouchelle, B. N.
Glascock, C. C.
Gould, W. E.
Renouf, V. A.
Ross, W. L.
Stidman, A. G.

Popular Latin: Professor Elliott. Monday, 12 m., Room 2. (5).

Batchelder, J. D.
Gould, W. E.
Leigh, J. E.
Mosemiller, C. A.
Stidman, A. G.

Dante: (*Lectures*): Professor Elliott. Wednesday, 12 m., Room 2. (4).

Batchelder, J. D.
Gould, W. E.
Shaw, J. E.
Stidman, A. G.

Historical Italian Grammar: Dr. Armstrong. Wednesday and Friday, 10 a. m., Room 6. (1).

Shaw, J. E.

Spanish Philology: Dr. Marden. Wednesday and Friday, 10 a. m., Room 2. (3).

Batchelder, J. D.
Gould, W. E.
Mosemiller, C. A.

Beginnings of Spanish Literature: Dr. Marden. Thursday, 11 a. m., Room 2. (4).

Batchelder, J. D.
Gould, W. E.
Mosemiller, C. A.
Teillard, X.

Old Spanish Readings: Dr. Marden. Friday, 12 m., Room 2.

Batchelder, J. D.
Gould, W. E.
Mosemiller, C. A.

Methodology of the Romance Languages: Dr. Keidel. Th day, 12 m., Room 2. (7).

Batchelder, J. D.
Frein, P. J.
Gould, W. E.
Martin, W. E.
Mosemiller, C. A.
Stidman, A. G.
Teillard, X.

Romance Club: Professor Elliott. Wednesday, 11 a. m., Room 2. (

Armstrong, E. C.
Batchelder, J. D.
Frein, P. J.
Gould, W. E.
Keidel, G. C.
Marden, C. C.
Mosemiller, C. A.
Nitze, W. A.
Ogden, P.
Shaw, J. E.
Stidman, A. G
Wilson, R. H.

Undergraduate Courses.

French: (*Major Course*): Associate Professor Rambeau. Daily, exc Tuesday, 10 a. m., Room 7. (6).

Davidson, G. D.
Downes, H. C.
Fosnocht, E. B.
Jones, T. D.
Kurrelmeyer, H.
Turnbull, B.

French: (*Minor Course, Class A*): Associate Professor Rambeau. Da except Thursday, 12 m. (17).

Abercrombie, R. T.
Beeuwkes, C. J.
Brady, J. H.
Flinn, F. B.
Glaser, O. C.
Greene, J. D.
Griffin, E. J.
Harris, W. H.
Hill, W. B.
Homer, H. L.
Kohn, W. L.
Lindheim, N. R.
Moore, J. S.
Powell, M. W.
Smith, W. L.
Taneyhill, G. I
Wharey, J. B.

French: (*Minor Course, Class B*): Dr. Ogden. Daily, except Thu day, 12 m., Room 6. (18).

Bogue, H.
Brooks, C. E.
Chambers, L. M.
Clark, C. T.
DeGrange, M.
Fisher, F. C.
French, J. C.
Greenbaum, H. S.
Kerr, R. C.
King, J. H.
Marshall, T. H.
Martin, W. E.
Moore, J. H.
Perkins, H. F.
Ross, W. L.
Spilman, E. A.
Wirt, C. B.
Wright, A.

French: (*Elementary Course*): Dr. Armstrong. Tuesday, Wednesd Friday, 9 a. m., Room 10. (3).

Hazen, H. H.
Murkland, P. A.
Stephens, J. L.

French: (*Elective Course*): Dr. Keidel.

Section I: Monday and Wednesday, 12 m., Room 12. (6).

Bouchelle, B. N.
Jungbluth, M.
Remsen, C. M.
Roulston, R. B.
Taveau, R.
Werber, O. S.

Section II: Monday, 9 a. m., Room 10; Thursday, 1 p. m., Room 2. (

Bruce, E. S.
Clunet, F. J.
Guggenheimer, C. M.
Harwood, S. P.
Krager, W. M.
Mullen, J. M.
Peters, J. G.

Italian: (*Minor Course*): Associate Professor Rambeau. Daily, exce Monday, 9 a. m., Room 7. (2).

Read, W. A.
Wight, C.

Italian: (*Elective Course*): Dr. R. H. Wilson. Wednesday and Frida 1 p. m., Room 2. (1).

Davidson, G. D.

Spanish: (*Minor Course*): Dr. Marden. Daily, except Monda 9 a. m, Room 8. (5).

Bouchelle, B. N.
Canter, H. V.
Clunet, F. J.
Schermerhorn, A. V. R.
Taveau, R.

Spanish: (*Elective Course*): Dr. Marden. Wednesday and Frida 1 p. m., Room 12. (8).

Bandel, J. M.
Eager, J. H.
Glascock, C. C.
Kurrelmeyer, H.
Liddell, D. M.
Parham, D. P.
Thomas, R. H.
Wharey, J. B.

History, Politics, and Economics. (118 Students)

Classes meet in McCoy Hall.

Historical Seminary: Professor Adams. Alternate Fridays, 8 p. Room 25. (28).

Adams, T. S.
Arnold, B. W.
Atkinson, J. N.
Barnett, G. E.
Boggs, W. J.
Brander, W. W.
Campbell, H.
Dickerson, E. T.
Drewry, W. S.
Ewing, J. R.
Garrett, R.
Groome, P. L.
Marston, O. J.
Martin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Sioussat, St. G.
Smith, V. E.
Sommerville, C.
Sumwalt, J. W.
Thom, W. T.
Tyler, J. C.
Weaver, C. C.

Germanic History: Professor Adams. Wednesday and Thursd 11 a. m., Room 25. (29).

Arnold, B. W.
Atkinson, J. N.
Barnett, G. E.
Boggs, W. J.
Brander, W. W.
Campbell, H.
Dawson, J.
Dickerson, E. T.
Drewry, W. S.
Garrett, R.
Hicks, F. C.
Hood, F.
Marston, O. J.
Martin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Schneider, J. P.
Sioussat, St. G.
Smith, V. E.
Sommerville, C.
Sumwalt, J. W.
Thom, W. T.
Tyler, J. C.
Weaver, C. C.

Nineteenth Century: Professor Adams. Friday, 11 a. m., Room (29).

Adams, T. S.
Atkinson, J. N.
Boggs, W. J.
Brander, W. W.
Campbell, H.
Clarke, G. M.
Dawson, J.
Drewry, W. S.
Ewing, J. R.
Garrett, R.
Groome, P. L.
Guthrie, C. E.
Marston, O. J.
Martin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S.
Palmer, J. H.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Sioussat, St. G.
Smith, V. E.
Sommerville, C
Sumwalt, J. W
Thom, W. T.
Weaver, C. C.
West, H. S.

ory of Civilization: (*Major History*): Professor Adams. Mon- and Tuesday, 11 a. m., Room 24. (32).

son, J. N.
rkes, C. J.
, W. J.
', J. H.
, C. T.
inge, M.
rson, E. T.
C. E.
Foster, F.
Garrett, R.
Grasty, J. S.
Heyman, S.
Hill, H. D.
Hill, J. P.
Homer, H. L.
Lindheim, N. R.
Marshall, T. H.
Marston, O. J.
Martin, W. E.
Miller, R. D.
Moore, J. S.
Palmer, J. H.
Renouf, V. A.
Schermerhorn, A. V. R.
Shriver, W. P.
Smith, V. E.
Smith, W. L.
Spencer, E. M.
Stephens, C. G.
Tyler, J. C.
Wingert, M.
Wright, H. C.

orical Conference: Associate Professor Vincent. Alternate sdays, 3–5 p. m., Room 23. (11).

y, W. S.
on, O. J.
n, W. E.
Miller, R. D.
Motley, D. E.
Radcliffe, G. L. P.
Sioussat, St. G. L.
Sommerville, C. W.
Sumwalt, J. W. R.
Thom, W. T.
Weaver, C. C.

l and Economic Europe: Associate Professor Vincent. sday and Thursday, 10 a. m., Room 23. (18).

d, B. W.
tt, G. E.
y, W. S.
ne, P. L.
on, O. J.
Martin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Sioussat, St. G. L.
Sommerville, C. W.
Sumwalt, J. W. R.
Thom, W. T.
Weaver, C. C.

pean History: (*Major History*): Associate Professor Vincent. rsday and Friday, 11 a. m., Room 23. (21).

rkes, C. J.
', J. H.
, C. T.
inge, M.
C. E.
r, F.
Grasty, J. S.
Heyman, S.
Hill, H. D.
Hill, J. P.
Homer, H. L.
Lindheim, N. R.
Marshall, T. H.
Moore, J. S.
Schermerhorn, A. V. R.
Shriver, W. P.
Smith, W. L.
Spencer, E. M.
Stephens, C. G.
Wingert, M.
Wright, H. C.

orical Politics: (*History-Economics Course*): Associate Professor CENT. Monday and Wednesday, 10 a. m., Room 23. (21).

, H.
elle, B. N.
bers, L. M.
n, F. H.
r, A.
r, F. C.
Flinn, F. B.
French, J. C.
Kalb, J. A.
King, J. H.
Lazenby, M.
Liddell, D. M.
Palmer, J. H.
Remsen, C. M.
Ross, W. L.
Smull, M. N.
Spilman, E. A.
Stein, J. S.
Thomas, R. H.
Ver Planck, De L.
Winslow, N.

rican Economic History: Dr. Ballagh. Tuesday, 11 a. m., m 20. (8).

d, B. W.
ler, W. W.
Drewry, W. S.
Hicks, F. C.
McBryde, M. B.
Motley, D. E.
Radcliffe, G. L. P.
Sommerville, C. W.

icipal and Local Government: Dr. Ballagh. Friday, n., Room 20. (5).

rde, M. B.
iffe, G. L. P.
Rayner, A. W.
Rickey, H.
Weaver, C. C.

ral History Examinations: Dr. Ballagh. Thursday, m., Room 20. (6).

, J. R.
y, D. E.
Schmeckebier, L. F.
Sioussat, St. G. L.
Sommerville, C. W.
Thom, W. T.

hern History: Dr. Ballagh. Friday, 3 p. m., Room 20. (5).

y, W. S.
y, D. E.
Radcliffe, G. L. P.
Sommerville, C. W.
Weaver, C. C.

ical and Early European History: (*Minor History*): Dr. LAGH. Daily, except Tuesday, 10 a. m., Room 20. (16).

eim, B. M.
, N.
', J. H.
, E. B.
Byrne, H. S.
Duck, R. S.
Griffin, E. J.
Harris, W. H.
Harwood, S. P.
Kohn, W. I.
Murkland, P. A.
Norton, E. L.
Raffel, H. B.
Sayler, J. A.
Tyler, J. E.
Whitman, H. S.

ical Conference: Dr. Willoughby. Alternate Thursdays,) p. m., Room 20. (3).

s, T. S.
Radcliffe, G. L. P.
Weaver, C. C.

ed States Constitutional Law: Dr. Willoughby. Monday Tuesday, 12 m., Room 20. (7).

d, B. W.
ler, W. W.
Clarke, G. M.
Marston, O. J.
McBryde, M. B.
Palmer, J. H.
Tyler, J. C.

l Aspect of Economic and Industrial Problems: Dr. LOUGHBY. Wednesday and Thursday, 12 m., Room 20. (12).

s, T. S.
d, B. W.
tt, G. E.
Brander, W. W.
Campbell, H.
Clarke, G. M.
Myers, W. S.
Palmer, J. H.
Radcliffe, G. L. P.
Sioussat, St. G. L.
Sommerville, C. W.
Weaver, C. C.

rican Political and Constitutional History: (*Major tics*): Dr. Steiner. Monday and Tuesday, 12 m., Room 24. (35).

son, J. N.
iston, A. H.
, W. J.
, A. A.
, E. S.
bell, H.
rson, E. T.
es, H. C.
y, W. S.
Fooks, W. M.
Frank, S. W.
Gaddess, C. C.
Grimes, R. H.
Guggenheimer, C. M.
Hanna, H. S.
Harwood, S. P.
Jones, T. D.
Joyner, L. L.
Jungbluth, K.
Kalb, J. A.
Keidel, A.
Knapp, G. W.
Krager, W. M.
Levering, J.
Motley, D. E.
Mullen, J. M.
Murkland, P. A.
Peters, J. G.
Rayner, A. W.
Renouf, V. A.
Reymann, L. A.
Robinson, G. C.
Smith, V. E.
Ver Planck, De L.
Weaver, C. C.

ory of English Law: Dr. Lee. Tuesday, 1 p. m., Room 24. (16).

son, J. N.
iston, A. H.
, W. J.
, G. M.
Dickerson, E. T.
Ensor, J. T.
Ewing, J. R.
Groome, P. L.
Guthrie, C. E.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Sioussat, St. G. L.
Smith, V. E.
Tyler, J. C.
Weaver, C. C.

English Political and Constitutional History: (*Major Politics*): Dr. Lee. Wednesday and Friday, 12 m., Room 24. (29).

Atkinson, J. N.
Blackiston, A. H.
Boggs, W. J.
Bruce, E. S.
Dickerson, E. T.
Downes, H. C.
Ensor, J. T.
Fooks, W. M.
Frank, S. W.
Gaddess, C. C.
Grimes, R. H.
Groome, P. L.
Guggenheimer, C. M.
Guthrie, C. E.
Hanna, H. S.
Harwood, S. P.
Jones, T. D.
Joyner, L. L.
Kalb, J. A.
Keidel, A.
Knapp, G. W.
Krager, W. M.
Mullen, J. M.
Peters, J. G.
Renouf, V. A.
Reymann, L. A.
Robinson, G. C.
Smith, V. E.
Tyler, J. C.

Spanish-American Relations: Dr. Callahan. Monday and Wednesday, 10 a. m., Room 25. (15).

Adams, T. S.
Barnett, G. E.
Brander, W. W.
Dickerson, E. T.
Marston, O. J.
Martin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S.
Schmeckebier, L. F.
Sioussat, St. G. L.
Sommerville, C. W.
Thom, W. T.
Weaver, C. C.

Economic Seminary: Associate Professor Sherwood and Dr. Hollander. Thursday, 4–6 p. m., Room 21. (12).

Adams, T. S.
Atkinson, J. N.
Barnett, G. E.
Campbell, H.
Dickerson, E. T.
Drewry, W. S.
Marston, O. J.
Myers, W. S.
Renouf, V. A.
Schmeckebier, L. F.
Smith, V. E.
Tyler, J. C.

Relation of Economics to Law: Associate Professor Sherwood. Monday, 9 a. m., Room 24. (10).

Adams, T. S.
Atkinson, J. N.
Barnett, G. E.
Blackiston, A. H.
Brander, W. W.
Campbell, H.
Dickerson, E. T.
Marston, O. J.
Renouf, V. A.
Tyler, J. C.

Corporations: Associate Professor Sherwood. Thursday and Friday, 9 a. m., Room 24. (15).

Adams, T. S.
Atkinson, J. N.
Barnett, G. E.
Brander, W. W.
Campbell, H.
Dickerson, E. T.
Drewry, W. S.
Garrett, R.
Miller, R. D.
Myers, W. S.
Palmer, J. H.
Renouf, V. A.
Smith, V. E.
Sumwalt, J. W. R.
Tyler, J. C.

Elements of Economics: (*History-Economics Course*): Associate Professor Sherwood. Thursday and Friday, 10 a. m., Room 24. (19).

Bogue, H.
Bouchelle, B. N.
Chambers, L. M.
Cronin, F. H.
Ember, A.
Fisher, F. C.
Flinn, F. B.
French, J. C.
Kalb, J. A.
King, J. H.
Lazenby, M.
Liddell, D. M.
Remsen, C. M.
Ross, W. L.
Smull, M. N.
Spilman, E. A.
Stein, J. S.
Thomas, R. H.
Winslow, N.

Elements of Economics: (*Minor Course*): Associate Professor Sherwood. Thursday and Friday, 10 a. m., Room 24. (21).

Beeuwkes, C. J.
Boggs, W. J.
Bruce, E. S.
Clark, C. T.
DeGrange, M.
Ford, C. E.
Gemmill, J. R.
Grasty, J. S.
Grimes, R. H.
Heyman, S.
Hill, J. P.
Lindheim, N. R.
Marshall, T. H.
Moore, J. S.
Mullen, J. M.
Peters, J. G.
Schermerhorn, A. V. R.
Shriver, W. P.
Spencer, E. M.
Stephens, C. G.
Wingert, M.

Development of Economic Theories: Dr. Hollander. Tuesday and Wednesday, 9 a. m., Room 24. (13).

Adams, T. S.
Barnett, G. E.
Brander, W. W.
Campbell, H.
Clarke, G. M.
Dickerson, E. T.
Drewry, W. S.
Groome, P. L.
Martin, W. E.
Miller, R. D.
Myers, W. S.
Renouf, V. A.
Smith, V. E.

Recent Economic Changes: (*Elective Course*): Dr. Hollander. Thursday, 12 m., Friday, 1 p. m., Room 21. (19).

Atkinson, J. N.
Dickerson, E. T.
Downes, H. C.
Fooks, W. M.
Gaddess, C. C.
Hanna, H. S.
Hood, F.
Jones, T. D.
Joyner, L. L.
Jungbluth, K.
Knapp, G. W.
Marston, O. J.
Rayner, A. W.
Reymann, L. A.
Rickey, H.
Sioussat, St. G. L.
Sumwalt, J. W. R.
Tyler, J. C.
Ver Planck, De L.

History of Economic Thought: (*Minor Course*): Dr. Hollander. Monday and Wednesday, 10 a. m., Room 24. (21).

Beeuwkes, C. J.
Bruce, E. S.
Clark, C. T.
Clunet, F. J.
DeGrange, M.
Ford, C. E.
Gemmill, J. R.
Grasty, J. S.
Grimes, R. H.
Heyman, S.
Hill, J. P.
Lindheim, N. R.
Marshall, T. H.
Moore, J. S.
Mullen, J. M.
Peters, J. G.
Schermerhorn, A. V. R.
Shriver, W. P.
Spencer, E. M.
Stephens, C. G.
Wingert, M.

Philosophy. (60 Students).

Classes meet in Room 12, McCoy Hall.

History of Philosophy: (*For Graduate Students*): Professor Griffin. Friday, 4 p. m. (11).

Archibald, H. T.
Brander, W. W.
Groome, P. L.
Guernsey, R.
Hood, F.
Jones, J. W.
Martin, W. E.
Rabinovitch, I. E.
Radcliffe, G. L. P.
Sioussat, St. G. L.
Weaver, C. C.

Deductive and Inductive Logic: until December 23; ***Psychology:*** January 3 to March 29; ***Ethics:*** after April 5: Professor Griffin. Daily, 11 a. m. ***Outlines of the History of Philosophy:*** Weekly. (50).

Armstrong, J. R. C.
Bogue, H.
Bruce, E. S.
Chambers, L. M.
Clunet, F. J.
Davidson, G. D.
Downes, H. C.
Fisher, F. C.
Flinn, F. B.
Fooks, W. M.
Fosnocht, E. B.
Frank, S. W.
French, J. C.
Gaddess, C. C.
Gemmill, J. R.
Greenbaum, H. S.
Grimes, R. H.
Guggenheimer, C. M.
Hanna, H. S.
Harwood, S. P.
Haskell, L. W.
Jones, J. W.
Jones, T. D.
Joyner, L. L.
Jungbluth, K.
Jungbluth, M.
Kalb, J. A.
Keidel, A.
King, J. H.
Knapp, G. W.
Krager, W. M.
Kurrelmeyer, H.
Lazenby, M.
Levering, J.
Morgan, P. S.
Mullen, J. M.
Murkland, P. A.
Palmer, E. L.
Peters, J. G.
Remsen, C. M.
Reymann, L. A.
Robinson, G. C.
Ross, W. L.
Routh, J. E.
Smull, M. N.
Spilman, E. A.
Taveau, R.
Thomas, R. H.
Ver Planck, De L.
Werber, O. S.

Drawing. (75 Students).

Classes meet in the Howard Street building.

Freehand Drawing: Mr. Whiteman. Tuesday and Thursday, 2–5 p. m., Room 18. (64).

Baldaut, L. K.
Bandel, J. M.
Beck, G. C.
Bird, A. R.
Booker, J. M.
Boyer, N.
Braun, J.
Briscoe, J. S.
Brown, E. B.
Bruton, A. W.
Bye, M.
Byrne, H. S.
Cook, T. G.
Cronin, F. H.
Dapprich, F. R.
Duck, R. S.
Ember, A.
Fenwick, B. L.
Fishach, L. G.
Griffin, E. J.
Griffith, W. A.
Guggenheimer, C. M.
Harris, W. H.
Hatch, E. C.
Hazen, H. H.
Hill, W. B.
Hollander, L.
James, W. McC.
Kohn, W. I.
Leopold, E. J.
Lilly, W. L.
Lisberger, S. J.
Lowndes, E.
Machen, J. G.
Maury, R. M.
Miller, H. C.
Morse, R. B.
Mower, F. D.
Mower, McH.
Noble, E. R.
Norton, E. L.
Powers, H. W. S.
Preston, J. O.
Raffel, H. B.
Reeves, E. D.
Rehberger, G. E.
Riggins, J. A.
Sayler, J. A.
Shippen, L. P.
Shreve, O. F.
Smith, R. T.
Spencer, L. C.
Stein, J. S.
Stephens, J. L.
Straus, H. P.
Strouse, E.
Struth, O. A.
Swindell, W. B.
Tyler, J. E.
Vogeler, C. A.
Warner, H. M.
West, A. P.
Wolf, M. W.
Zies, F.

Mechanical Drawing: Mr. Geer. Thursday and Friday, 2–5 p. m., Rooms 9 and 18. (11).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Estill, H. S.
Fitzgerald, T.
Illmer, L.
Nightingale, C E.
Pender, H.
Schoepf, F. H.
Swaine, J. W.

Forensics and Elocution. (167 Students).

Classes meet in McCoy Hall.

Debate and Parliamentary Practice: *Third Year* (*Senate*): Dr. Lee. Wednesday, 11 a. m., Donovan Room. (45).

Armstrong, J. R. C.
Bogue, H.
Bruce, E. S.
Chambers, L. M.
Davidson, G. D.
Downes, H. C.
Fisher, F. C.
Flinn, F. B.
Fooks, W. M.
Fosnocht, E. B.
Frank, S. W.
French, J. C.
Gaddess, C. C.
Gemmill, J. R.
Greenbaum, H. S.
Grimes, R. H.
Guggenheimer, C. M.
Hanna, H. S.
Haskell, L. W.
Jones, T. D.
Joyner, L. L.
Jungbluth, K.
Kalb, J. A.
Keidel, A.
King, J. H.
Knapp, G. W.
Krager, W. M.
Kurrelmeyer, H.
Lazenby, M.
Levering, J.
Morgan, P. S.
Mullen, J. M.
Murkland, P. A.
Peters, J. G.
Remsen, C. M.
Reymann, L. A.
Robinson, G. C.
Ross, W. L.
Smull, M. N.
Spilman, E. A.
Taveau, R.
Thomas, R. H.
Ver Planck, De L.
Werber, O. S.
Wright, A.

Conference in Parliamentary Practice: Dr. Lee. Monday, 8 a. m., Room 22. (18).

Bruce, E. S.
Chambers, L. M.
Davidson, G. D.
Downes, H. C.
Flinn, F. B.
French, J. C.
Greenbaum, H. S.
Guggenheimer, C. M.
Jones, T. D.
Krager, W. M.
Morgan, P. S.
Murkland, P. A.
Peters, J. G.
Reymann, L. A.
Ross, W. L.
Ver Planck, De L.
Werber, O. S.
Wright, A.

Debate and Parliamentary Law: *Second Year* (*House of Representatives*): Dr. Lee. Thursday, 12 m., Donovan Room. (45).

Abercrombie, R. T.
Anderson, R. B. T.
Baetjer, H.
Beeuwkes, C. J.
Bouchelle, B. N.
Brady, J. H.
Breed, A. A.
Brooks, C. E.
Burrell, J. L. A.
Clark, C. T.
DeGrange, M.
Eager, J. H.
Ewell, J. E.
Flinn, F. B.
Ford, C. E.
Foster, F.
Francis, I. H.
Glaser, O. C.
Greene, J. D.
Griffin, J. W.
Heyman, S.
Hill, H. D.
Hill, J. P.
Hyde, E. P.
Kerr, R. C.
Liddell, D. M.
Lindheim, N. R.
Mackall, L. L.
Marshall, T. H.
McAll, R. L.
Moore, J. S.
Powell, M. W.
Purcell, T. N. D.
Roulston, R. B.
Rous, F. P.
Routh, J. E.
Schermerhorn, A. V. R.
Shriver, W. P.
Smith, W. L.
Stephens, C. G.
Taneyhill, G. L.
Whitman, H. S.
Wight, C.
Wingert, M.
Wright, H. C.

Conference in Parliamentary Law: Dr. Lee. Tuesday, 8 a. m., Room 22. (19).

Abercrombie, R. T.
Anderson, R. B. T.
Bouchelle, B. N.
Brady, J. H.
Breed, A. A.
Brooks, C. E.
Burrell, J. L. A.
Foster, F.
Francis, I. H.
Hyde, E. P.
Liddell, D. M.
Lindheim, N. R.
Marshall, T. H.
McAll, R. L.
Moore, J. S.
Routh, J. E.
Shriver, W. P.
Stephens, C. G.
Wingert, M.

Elocution: *First Year:* Dr. Lee. Assembly Room.

Wednesday, 1 p. m. (22).

Baldauf, L. K.
Bird, A. R.
Brown, E. B.
Byrne, H. S.
Cronin, F. H.
Duck, R. S.
Fenwick, B. L.
Hatch, E. C.
Homer, H. L.
Kohn, W. I.
Lilly, W. L.
Lisberger, S. J.
Maury, R. M.
Miller, H. C.
Morse, R. B.
Mower, McH.
Reeves, E. D.
Riggins, J. A.
Shippen, L. P.
Shreve, O. F.
Spencer, E. M.
Vogeler, C. A.

Thursday, 1 p. m. (22).

Bandel, J. M.
Bernheim, B. M.
Boyer, N.
Bruton, A. W.
Constantine, C. W.
Dapprich, F. R.
Griffith, W. A.
Hazen, H. H.
Hill, W. B.
Norton, E. L.
Raffell, H. B.
Rehberger, G. E.
Sayler, J. A.
Smith, R. T.
Stein, J. S.
Stephens, J. L.
Strouse, E.
Struth, O. A.
Swindell, W. B.
Turnbull, B.
Tyler, J. E.
Zies, F.

Friday, 1 p. m. (22).

Booker, J. M.
Brann, J.
Briscoe, J. S.
Bye, M.
Cook, T. G.
Ember, A.
Fishach, L. G.
Griffin, E. J.
Harris, W. H.
Hollander, L. M.
James, W. McC.
Leopold, E. J.
Lowndes, E.
Machen, J. G.
Manken, H.
Mower, F. D.
Noble, E. R.
Powers, H. W. S.
Snavely, G. E.
Spencer, L. C.
Straus, H. P.
Warner, H. M.

Public Lecturing and Extemporaneous Speaking: (*For Graduate Students*): Dr. Lee. Monday, 1 p. m., Donovan Room. (11).

Adams, T. S.
Atkinson, J. N.
Ballard, H. H.
Dickerson, E. T.
Fischer, J. S
Foote, T. C.
Montgomery, W. A.
Pyle T. L.
Renouf, V. A.
Sioussat, St. G. L.
Schmeckebier, L. F.

STUDENTS IN THE JOHNS HOPKINS MEDICAL SCH

Candidates for the Degree of M. D. (197).

Fourth Year. (33).

Brownell, E. E.
Buckler, H. W.
Cole, R. I.
Davis, F. C.
Davis, J. S.
Emerson, C. P.
Epler, B. N.
Erlanger, J.
Evans, P. S., Jr.
Follis, R. H., Jr.
Fulton, F. T.
Gallagher, J. D.
Harris, H.
Hoye, H. J.
Ladd, L. W.
Little, C. S.
Luetscher, J. A.
Lupton, F. A.
Lynch, F. W.
Magee, C. L.
Moore, H. M.
Ottley, C. W.
Owsley, P. O.
Pleasants, J. H., Jr.
Rosenheim, S.
Sampson, J.
Steensland,
Stone, W. R
Strobel, E.
Verhoeff, F.
Williams, W
Wyckoff, S.
Yates, L.

Third Year. (43).

Akerman, J.
Allen, H. W.
Austin, M. F.
Beale, A. E.
Bettman, M.
Briggs, E.
Brülle, H.
Burnam, C. F.
Chace, E. S.
Chittenden, A. S.
Christian, H. A.
Dancy, W. R.
Eggers, A. H.
Evans, H. C.
Fairbank, R.
Farrar, C. B.
Fisher, A. L.
Fisher, W. A., Jr.
Fletcher, H.
Flint, J. M.
Healy, W. P.
Hendrickson, W. F.
Hewlett, A. W.
Kellogg, W. C.
Kyes, P.
Lebus, L.
Lewis, W. H.
Little, H. W.
Lowell, E. L.
MacCallum, J. B.
Marvell M. W.
Meltzer, C. R.
Mosher, C. D.
Myrick, H.
Rand, R. F.
Reed, D. M.
Rusk, G. Y.
Sabin, F. R.
Sowers, W.
Stone, E. A.
Warren, M.
West, J. M.
Woolley, P.

Second Year. (59).

Atherton, A. M.
Baetjer, F. H.
Baldwin, W. D.
Berry, J. M.
Blakeslee, W. H.
Bloombergh, H. D.
Boggs, T. R.
Bosley, J. R.
Bunting, C. H.
Butler, J. I.
Carey, H. W.
Chowning, W. M.
Comer, R. T.
Connor, G. L.
Connor, R.
Drake, G. S., Jr.
Dutcher, A.
Fowler, H. A.
Gay, F. P.
Graham, N. D.
Hall, G. W.
Hamman, L. V.
Hastreiter, R. F.
Hathaway, J. H.
Hitzrot, J. M.
Holden, G. R.
Hume, E. H.
Johnston, W. B.
Kaufman, H. M.
Kimball, A. H.
Lamson, T.
Lewis, D. M.
Long, M.
Longcope, W. T.
Lyle, A. G.
Maddren, W. H.
McKeough, E. P.
Moore, E. S.
Parker, H. P.
Pullen, F. K.
Rubel, M. J.
Rushmore, S.
Salter, J. C.
Simis, M. P.
Slemons, J. M.
Smith, H. M
Spratt, C. N.
Stein, G.
Steinfeld, A.
Swett, C. M.
Ulrich, H. L
Underhill, A
Walker, M.
Warfield, L.
Warren, G.
Watts, S. H.
Wells, E. A.
Wells, M.
Winne, C.

First Year. (62).

Auer, J.
Briggs, J. B., Jr.
Browne, B. B.
Bruns, R. M.
Bryan, W. M. C.
Bush, C.
Chase, L. A.
Churchman, J. W.
Clarke, T. W.
Cook, H. W.
Coons, J. J.
Cooper, J. C.
Dohme, G. C.
Dolley, D. H.
Dudley, H.
Duffy, R.
Dunlop, J.
Eddy, D. L.
Erving, W. G.
Ferry, N. S.
Fogle, C. V.
Foster, N. B.
Francis, W. W.
Frankenthal, M. A.
Geraghty, J. T.
Glenny, W. H.
Grant, J. F.
Haviland, M L.
Haynes, M. S.
Hirshberg, L. K.
Horst, C. H.
Hyman, S.
Jelke, W. F.
Jones, T. M.
Karsted, A.
Lehr, L. C.
L'Engle, E. M.
Lincoln, M. W.
Litchfield, G. V., Jr.
Lootz, E.
Ludlum, S. D.
MacGregor, G. M.
Marshall, S. A.
McFarland, J. S.
Meisenhelder, E. W.
Meisenhelder, J. E.
Ochsner, H. W.
Pelton, G. I.
Reede, E. H.
Riggins, E.
Riggs, T. F.
Rogers, C. P.
Scholl, G. B.
Silverberg,
Simpson, J.
Tallant, A.
Van Arsdall,
Van Denbur
Wright, O. B
Williams, C.
Williams, D
Wright, C. B

Physicians attending Special Courses. (7).

Cone, C.
Curtiss, R. M.
Fearn, T.
Greenebaum, E. C.
Johnson, E. K.
Reuling, R.
Rich, H. L.

During the months of May and June, 1898, the Special Course
Graduates in Medicine were attended by 45 physicians. Their name
given in the first edition of the Annual Register, 1898–99, now ready.

ENROLLMENT OF STUDENTS.

[1898, November 17.]

Graduate Students (Philosophical Faculty), - - - - - -
Graduate Students (Medical Faculty), - - - - - -
Physicians attending Special Courses, - - - - - - -
Undergraduates and Special Students, - - - - - -

Physicians attending Special Courses in May and June, 1898 (not previously enrolled). - - - - - - - -

NOTES FROM THE SEMINARY OF HISTORY AND POLITICS.

EDITED BY PROFESSOR HERBERT B. ADAMS, PH. D., LL. D.

The Colonial Executive prior to the Restoration.

By PERCY LEWIS KAYE.

(Abstract of a paper read before the Historical and Political Science Association.)

The first permanent executive organized in Virginia consisted of a President and Council of seven members. This body was entrusted with the ill-advised power of deposing as well as electing its own officers, and of expelling members from their seats. The second charter, in 1609, provided for the concentration of political power within the colony in the hands of a Governor, to be appointed by the London Council. This Council, in February, 1610, issued a commission to Lord Delaware, which is noteworthy as being the first commission to a Lord Governor and Captain General in America. The first step in the separation of powers was made in 1618, when the Virginia Company instructed Governor Yeardley to summon an assembly of burgesses. No important change was made in the constitution of the executive in the colony by the dissolution of the Virginia Company in 1624, except that the appointing power fell to the king.

The Company which settled Massachusetts, by its removal to the colony, itself became the Commonwealth. The executive officers were thus chosen within the colony, and were the true servants and representatives of the Commonwealth, not of the home government as in Virginia. At first the Governor was chosen by the aristocratic Council of Assistants. But the democratic tendencies of the colony soon led to his election being placed in the hands of the general body of freemen, and, not being supported by any power outside the colony, he was compelled to yield supremacy to the popular legislative body, the General Court.

The Governor and other chief executive officers in Maryland were appointed by the Proprietor. In all these colonies, one of the chief functions of the executive was judicial. The Governor and Council formed the Supreme Court within the colony, except in the case of Massachusetts, where an appeal lay to the General Court.

Owing to the practically sovereign powers granted in the charters, the English government soon experienced difficulty in controlling the colonies. The executive was always the channel through which attempts were made to regulate their affairs. The Privy Council had charge of colonial matters, which were transacted through standing committees appointed from time to time with full power to investigate and take cognizance of all business relating to the colonies. It was the desire of the home government to set up a general executive officer or Governor in Chief over all the colonies. But this policy originated long before the Restoration, not after it, as is frequently supposed.

Though there was no thought of separation of powers in the charters, distinct steps were made in that direction during this period. The freemen claimed the law-making and taxing powers as their special province. It is to this period that must be referred the origin of the wrangling disputes between the two branches of government about the limits of their powers. Though the assemblies became a permanent and important element of the governments, it was only in Massachusetts that the executive was reduced to a subordinate position.

Robert Goodloe Harper (1765-1825). By C. W. SOMMERVILLE.

[illegible] read before the Historical and Political Science Association.)

[illegible] but his family early moved

[illegible] he

Washington and Adams. He ably defended the Jay treaty at a time when the country was wild with excitement. There was talk of impeaching Washington. Hamilton was attacked by a mob that would not listen to his explanation of the advantages of the Jay treaty. Against the encroachments of France Mr. Harper's voice was constantly heard. His pamphlet entitled "Observations on the Dispute with France," was published in both America and in England, translated into Portuguese, and attracted much attention. As chairman of the Ways and Means Committee, Mr. Harper did efficient service. Retiring from Congress he married the daughter of Charles Carroll of Carrollton, and settled in Baltimore, where he soon took a leading place at the Bar. He was engaged in the first three impeachment trials under our Constitution. His eloquent defence of Judge Chase gave Harper a national reputation. In 1816 he represented Maryland in the United States Senate, but resigned before the expiration of his term and became a candidate for the Vice-Presidency.

During the remainder of his life, General Harper took a very active part in the work of the American Colonization Society, of which he was for some years a vice-president. The West African country of Liberia and its chief town, "Monrovia," were named by him, while the town of "Harper" still bears his name. In 1819-20 General Harper travelled in Europe where he met with distinguished recognition. His life in Baltimore was marked by an active interest in the general welfare of the city. He took a prominent part in its establishment of the first water-works, in the organization of the Exchange, and in the Chesapeake and Ohio Canal schemes which preceded the building of the Baltimore and Ohio Railroad. In the defence of Baltimore in 1814, Harper played a gallant part, and was shortly afterwards made Major General of the Maryland troops. In this capacity he took part in the laying of the corner-stone of the Washington and Battle Monuments and in the reception of Lafayette by the city.

The Know Nothing Party in Maryland. By L. F. SCHMECKEBIER.

(Abstract of a paper read before the Historical and Political Science Association.)

The Know Nothing party was one of the most unique political organizations which ever appeared in American politics. With its proceedings shrouded in secrecy, it first made its power felt by the victories which it won in the local elections. In its early days no call for a meeting was ever published, or if it was, it was by means of a cabalistic notice, the meaning of which was known to the initiated. Meetings were generally called by means of bits of paper stuck upon fences or scattered over the street. The members professed profound ignorance concerning the party, and in this way it obtained its popular sobriquet of "Know Nothing." The object of the party was to secure a longer term of residence for immigrants before naturalization, and to oppose the Roman Catholic Church.

The party first made its appearance in Maryland either in the fall of 1852 or the spring of 1853. It spread rapidly, and in a short time had extended all over the State. Not until 1854 did it put forth any candidates. In that year it nominated and elected its candidate for Mayor of Baltimor and also a majority in both branches of the City Council. With 1854 end the secret organization of the party, and after this time it adopted the curre political methods. Again in 1855, after an exciting campaign, the Kn Nothings were successful.

The Presidential campaign of 1856 was more exciting than any wh had preceded it. The chief interest was centered in Baltimore, wher Presidential canvas was carried on concurrently with the municipal

ss of the Know Nothing party in Maryland was due to:—(1).
reased immigration and the active participation of the new-
litics. (2). The efforts of the Catholics to obtain a division of
hool fund in favor of sectarian schools; the visit of a Papal
the ultramontane position taken by some Catholic journals.
iddle course taken by the party on the slavery question; and
l popularity of Millard Fillmore. (4). The disappearance of
rty, and dissatisfaction in the ranks of the Democratic party.
neral political unrest of the period.
of the year 1856 sharply divides the history of the party.
is date principles are entirely lost sight of in the struggle for
Democratic party offered no effective resistance, and elections
l by fraud and intimidation. Four years longer did the party
imore, and not until the control of the police was taken away
ayor and put in the hands of the State authorities did the
e Know Nothings come to an end.

ntroduction of Slavery into North America.

ALLAGH.

f a paper read before the Historical and Political Science Association.)

hould be viewed with especial reference to its institutional
In the fact of development it is similar to other social institu-
as the *Comitatus*, *Clientela*, etc. It originated in essential
of capacity or opportunity between individuals or sets of
Dependence results chiefly from considerations of race, religion,
political condition imposed by birth, education or conquest,
ciety. Incident rights and duties become fixed by law or cus-
s differing in degree at various times and places according to
ions. Ancient and modern slavery are thus logically if not
connected. In its use as an organized form of dependent labor,
esents a stage in progressive social and industrial development
y related with other forms of labor, such as English villanage,
assalage, American and French colonial servitude and modern
so-called free labor. The status slavery in North America
a native development as it was in Africa, the Spanish colonies,
re. Both in the case of Indians and negroes it passed first
stage of servitude limited in time in most of the English
not in all. This was certainly true of Virginia, Maryland,
d, Pennsylvania, Georgia, North Carolina, and South Carolina.
ered from servitude chiefly in the perpetuity of the loss of
l civil liberty. Both the servant and the slave had a limited
n the other civil rights of personal security and private property.
he creation either of local customary and statute law or of that
eign community in Europe. In Dutch New York the doctrines
law of Holland were applied to recognize slavery. The African
was an incident of the era of discovery that marked the transi-
liaeval into modern times. Portugal through an accident of
cial expansion opened the slave trade in 1442. Spain by right
enslaved the heathen Indian in her American colonies and for
asons substituted for him the heathen negro. Civilized Europe
the trade. Commercial and political rivalry between England,
Holland introduced the negro into the English colonies. A
cantile company brought in 1616 the first negro servant to the
ith deliberate commercial design. First Dutch then English
panish commerce introduced in 1619 twenty negroes into Vir-
hers into the Bermudas. Traffic of this occasional kind brought
the first quarter of the century. These negroes were not slaves,
ding the probable intent of the importers As captives of
could not by the law of nations be treated as slaves. English
aw must fix their status. They were viewed as colony or public
he hands of government officials, a status similar to that of the
ts of Virginia and Bermudas. Personal ownership of the right
vices was first settled by court decisions in Bermudas in 1623
inia in 1625. Their legal condition was similar to that of white
egislation applying to servitude included negroes up to 1661
up to 1670 in Virginia, when perpetual servitude was recog-
tute. Statutory recognition of slavery by the colonies appears
wing order: Massachusetts in 1641, Connecticut in 1650, Virginia in 1661, Maryland in 1663, New York and New Jersey in 1664, South Carolina in 1682, Pennsylvania in 1700, North Carolina in 1715, and Georgia in 1755. The definition of full status by the addition of incidents demanded by social, economic, and political reasons was gradual, continuing through the eighteenth century in the North and until the second half of the nineteenth century in the South. All the colonies by duties tried to restrict the undue importation of slaves forced by England. Moral responsibility for the growth of an institution is not to be placed upon one age or nation. Generations of Portuguese, Spanish, Dutch, English, and American colonists each had their part in the development of slavery in America. The idea of slavery was an institutional legacy of the ancient to the modern world.

European Blue Laws. By J. M. VINCENT.

(Abstract of a paper read before the Historical and Political Science Association.)

Strict laws for the conduct of the private citizen were not a monopoly of the Puritan fathers. Regulations for clothing, eating, drinking and Sunday observance were found all over Europe during the same period in both Catholic and Protestant countries. In fact sumptuary laws were common during the middle ages and the reformers merely continued the old method of dealing with the problems of society. It was a general political maxim that authorities should regulate even the small particulars of life and manners.

In France as early as 1294 the clothing of the various ranks was established by law. No common citizen might wear fur, jewels, or gold. The noble who had 6,000 pounds a year might have four robes a year but no more; their ladies only a single gown. Common citizens who had 2,000 pounds a year might use cloth costing twelve and a half sous a yard. Persons with less incomes could only spend ten sous a yard. In Zürich in 1370 women must not wear cloth trimmed with goods of another color. The opening of the dress at the neck must leave at least two inches on the shoulders. The girdle must not cost more than five pounds and shoes must not extend in points beyond the foot. Trousers for men must not be made in stripes and both legs must be of the same color. These are sample regulations from the middle ages.

The reformation introduced greater sobriety but laws still seemed to be necessary. Much of the severity is laid at Calvin's door, but other communities were nearly as strict as Geneva. Zürich and Berne may be cited as examples among German speaking peoples. The significant fact is that inquisitorial laws continued to be enacted for nearly three centuries, and are found in operation as late or even later than the Blue Laws of the American colonies.

Examples of post-reformation rules may be cited from the laws of Zürich of 1628. Every person in the city, unless hindered by good reason, must be in church before the last bell rang and remain to the close of the service. Children must not remain on the street at night after the "bed bell" rang. Not only were taverns and club houses closely regulated, but citizens must drink according to rule. The afternoon drink must not begin before five and must stop at six. Guests must not stop at other taverns on the way home and when in their own houses no further drinks or "night caps" were allowed. The drinking of brandy or strong spirits was altogether forbidden before noon, except to strangers in the city. Guests at weddings and funerals were limited in number by law.

Similar strict regulations were in use in Berne in 1688. The garments forbidden to men and women were given by name. Silk, laces, and gold ornaments were to be used in greatest moderation. Ladies might not give a certain kind of reception. Wedding gifts are prescribed with the greatest exactitude. Dancing and masquerades were forbidden, and as for sleigh-riding, young women were forbidden to ride out with men unless it be their father; and young men must get their cutters out of the streets by nightfall. Visiting among such young people was improper, except for blood relations and those engaged to be married.

Laws in France were very strict under Louis XIV, for he desired to regulate everything in his kingdom. He enacted sumptuary laws for clothing sixteen times but finally gave it up. Fashion was too much for him. Sumptuary laws are found in Switzerland as late as 1755 and 1785, showing that the attempt to govern dress and private conduct had not yet been given up. In 1785 the smoking of tobacco in the streets or public places of Zürich was subject to fine or imprisonment.

TEACHERS' LECTURES AT THE JOHNS HOPKINS UNIVERSITY, 1898-99.

In response to a request for lectures especially adapted to the needs of Baltimore teachers, the Johns Hopkins University offers, during the current academic season, two class courses of instruction:

(1) An HISTORICAL SERIES of 20 lectures partly on Education, partly on England and America.

(2) A SCIENTIFIC SERIES of 20 lectures on (1) Physical Geography and (2) Geology.

The Historical Course began on Friday evening, November 4, at 8 o'clock, and will continue on successive Fridays.

The Scientific Course began on Saturday, November 5, at 9.30 a. m., and will continue on successive Saturdays.

Bibliographies and printed outlines of each course will be furnished without expense to the hearers. Each lecture will be preceded by a review of the previous lecture. Questions for written answers, which may be sent to the lecturer by those who are so inclined, will be given out from time to time, or printed in the syllabus, for the purpose of stimulating study at home. A written examination will be set at the end of each course, and the papers submitted will be returned with corrections or suggestions.

A fee of $3 is required by the University for the privilege of attending either the Scientific or the Historical Course of 20 lectures. For attendance, together with class work and final written examination, a fee of $5 is charged. A general ticket of admission must be shown at the door of the lecture room. Attendance will be reported at each lecture. A simple certificate combining attendance, class work, and final examination will be issued to those persons who successfully complete either course.

H. B. ADAMS, Professor of History, *Chairman*.
JOSEPH S. AMES, Professor of Physics.
WILLIAM B. CLARK, Professor of Geology.
Committee.

The HISTORICAL SERIES began with a course of ten lectures on the HIGHER EDUCATION OF THE PEOPLE, as follows:—

1.	*Introduction.*	By J. W. Martin:	Educational Work in London.
2.	Part I. *Adult Education.*	By H. B. Adams:	Summer Meeting of Teachers at Chester, England.
3.		" "	University Extension and a Cambridge Summer Meeting.
4.		" "	Summer Meetings for Teachers in Edinburgh and Paris.
5.	Part II. *Schools Modern and Mediæval.*	" "	Public Schools in Germany.
6.		" "	Popular Education in Scotland and England.
7.		" "	Schools and Universities in the Middle Ages.
8.	Part III. *Classic and Oriental.*	" "	Greek and Roman Education.
9.		" "	Hebrew and Early Christian Education.
10.		" "	Chinese and Japanese-American Education.

A statement of the SCIENTIFIC SERIES is made in *Circular* 137 (November, 1898). Most of the lectures will be given by Dr. W. B. SHATTUCK. The following is a syllabus of the course:—

November 5, Atmosphere; 12, Rain; 19, Rivers in general.
December 3, Classification of Rivers; 10, Life history of Niagara; 17, Lakes.
January 7, Oceans; 14, Ice in general; 21, Glaciers; 28, Organisms.
February 4, Volcanoes; 11, Mountain Building and Uplift in general; 18, Distribution; 25, Paleontology.
March 4, Precambrian; 11, Paleozoic; 18, Mesozoic; 25, Tertiary.
April 4, Quarternary; 15, History.

Dr. CLIFFORD ALLBUTT, Regius Professor of Medicine in the University of Cambridge, gave an address on "Medicine of the Nineteenth Century," before the Johns Hopkins Medical School, at the opening of the sixth session, October 17.

Professor BROOKS delivered a lecture on "Louis Agassiz and George [illegible]rkeley," October 24. During December he will deliver his course on [illegible] Foundations of Zoology," at Columbia University.

President GILMAN delivered an address on "Books and Poli
Princeton, October 22, and repeated it, in part, in McCoy Hall, Oc

Under the auspices of the American Committee for promoting t
parative Study of Religion, the fourth course of lectures will
during the session 1898–99, before the co-operating institutions, by
Professor KARL BUDDE, D. D., of the University of Strassbur
subject is "The Religion of Israel from the Earliest Times to the
These lectures will be given in McCoy Hall at 5 o'clock, beginning
December 5, and continuing daily until December 12, with the e
of Tuesday, December 6, and Sunday, December 11.

HOPKINS SCHOLARSHIPS.

Hopkins Scholarships for the year have recently been awarded
To Graduate Students:

Honorary.

W. S. DREWRY, of North Carolina.
W. S. MYERS, of North Carol

Ordinary.

H. CAMPBELL, of Virginia.
H. V. CANTER, of Virginia.
J. M. DOUGLAS, of North Carolina.
P. L. GROOME, of North Ca
R. W. HAYWOOD, of North Ca

To Undergraduates from Maryland:

Ordinary.

J. G. MACHEN,
R. B. MORSE,
L. M. HOLLANDER,
J. E. TYLER,
L. C. SPENCER.

The Class of 1893 at Williams College has established, in memo
late Dr. F. S. Conant, a prize in Natural History of twenty-five
This is to be used by the winner of the prize in payment of t
the Marine Laboratory at Wood's Holl.

The Johns Hopkins University Musical Association will give it
series of entertainments during the coming winter, and the
announcement has been published:

The Musical Association, formed at the Johns Hopkins Unive
year, will provide four evening entertainments, during the presen
in McCoy Hall. Three of these will be devoted to Chamber Mus
the direction of Mr. W. Edward Heimendahl, and on one of the
Professor Ames will give a scientific exhibition of Modern Acoust

Members who desire to continue their subscriptions, and person
to join the Association, are requested to send their subscriptio
Registrar of the University.

The annual dues are one dollar. Only persons enrolled in the
of the University, and their wives, are eligible to membership. T
ber of members is limited to two hundred and fifty. Each will
Member's Ticket, admitting to all entertainments. Members ma
in addition, Cards of Invitation—one dollar for the course—which
given to friends.

The first concert will be given Saturday, December 10, at eight

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PUBLIC MEETINGS AND SOCIAL ASSEMBLI

Recently held in the University Buildings:

Opening reception of the Young Men's Christian Association of
versity, in Levering Hall, October 3.

Annual meeting of the Baltimore Society of the Archaeological
of America, in the Donovan Room, followed by an illustrate
on the Acropolis of Athens by Dr. Mitchell Carroll, in Mc
November 10.

Annual public meeting of the Charity Organization Society of B
in McCoy Hall, November 10, when addresses were made
Carroll D. Wright, U. S. Commissioner of Labor, and Ed
Devine, Ph. D., General Secretary of the New York Charity
tion Society.

Second annual meeting of the Maryland Conference of Char
Correction, McCoy and Levering Halls, November 29 and 30.

PROCEEDINGS OF SOCIETIES.

Philological Association.

March 18, 1898.—One hundred and sixty-fifth regular meeting. Forty members were present.

Papers read:
On the Development of Visions of Heaven and Hell, with especial Reference to England, by E. J. BECKER.
A Letter of Esarhaddon, by C. JOHNSTON.

April 22.—One hundred and sixty-sixth regular meeting. Thirty-two members present.

Papers read:
Euphemistic Liturgical Appendixes in the Book of Isaiah, by K. J. GRIMM.
The Rhythmic Accent of Proper Names in Anglo-Saxon Versification, by J. W. BRIGHT.

May 20.—One hundred and sixty-seventh regular meeting. Thirty-one members were present.

Papers read:
Herodotus in the Renascence, by D. A. PENICK.
The French Preposition à in Expressions of Modality and in Expressions of Appurtenance, by R. H. WILSON.

October 21.—One hundred and sixty-eighth regular meeting. Forty-two members were present.

Papers read:
The Attic Orators and the Athenian Family, by C. A. SAVAGE.
The Myth of Purûravas and Urvaçî, by M. BLOOMFIELD.

November 18.—One hundred and sixty-ninth regular meeting. Forty-three members were present.

Papers read:
Aristotle and Greek Sculpture, by M. CARROLL.
Explanation of an Assyrian Crux Interpretum, by C. JOHNSTON.

Historical and Political Science Association.

March 18.
The Know-Nothing Party in Maryland, First Part, by L. F. SCHMECKEBIER.
Knapp's "Feudal and Modern Japan," by W. T. THOM.
Ball's "City of the Caliphs," by J. R. EWING.
Bazin's "Italians of To-day," by D. E. MOTLEY.
McCrady's "History of South Carolina under Proprietary Government," by W. W. BRANDER.
Hamilton's "Colonial Mobile," by C. C. WEAVER.

April 1.
The American City and Quasi-Public Works, by J. H. HOLLANDER.
H. C. Adams on "A Decade of Federal Railway Legislation," by C. H. BROUGH.
Friedenwald on "Jews in the Continental Congress," by W. S. MYERS.
Thatcher's "Europe in the Middle Ages," by W. S. DREWRY.
Cobb's "Story of the Palatines," by R. GARRETT.
Trent's 'Southern Statesmen of the Old Regime," by G. L. P. RADCLIFFE.
Scidmore's "Java: The Garden of the East," by ST. G. L. SIOUSSAT.

April 22.
Robert Goodloe Harper, by C. W. SOMMERVILLE.
War Revenue Bill, by T. S. ADAMS.
How Maine became a State, by L. F. SCHMECKEBIER.
Rowland's "Charles Carroll of Carrollton," by W. W. BRANDER.
Canadian Archives, by D. E. MOTLEY.
Boase's "Modern English Biography," by C. SNAVELY.
Frazer's "Pausanias," by C. W. PAINE.
Ratzel's "History of Mankind," by J. R. EWING.

May 6–7.
The George Junior Republic, by Dr. W. I. HULL, of Swarthmore College.
Willoughby's "Workingmen's Insurance," by G. E. BARNETT.
Olney on "International Isolation of the United States," by C. W. SOMMERVILLE.
Wallas on "The Life of Francis Place," by E. J. BENTON.
The Encyclopaedia of Social Reform, by J. F. SCHUNCK.
Atkinson's "Cambridge," by C. C. WEAVER.
Chesapeake and Ohio Canal, by G. W. WARD, of Western Maryland College.

May 20.
The Dulanys of Maryland, by ST. G. L. SIOUSSAT.
The Monroe Doctrine, by J. H. LATANÉ.
Levasseur on "L'Ouvrier Amèricain," by C. W. PAINE.
Waring on "Street Cleaning and its Effects," by W. S. MYERS.
Williams' "Made in Germany," by H. CAMPBELL.
Pobedonostzeff, by W. W. BRANDER.

June 3.
Methods of Historical Study in Secondary Schools, by H. B. ADAMS.
Butler on "The Meaning of Education," by L. F. SCHMECKEBIER.
Dewey on "The Primary-Education Fetich," by G. E. BARNETT.
Barneaud's "Origines et Progrès de l'Éducation en Amèrique," by C. W. SOMMERVILLE.
Student Life in the Sixteenth Century, by J. M. VINCENT.
Harris on "The Psychological Foundations of Education," by T. S. ADAMS.

October 7.
The Know-Nothing Party in Maryland, Second Part, 1857–1860, by L. F. SCHMECKEBIER.
Historical Work in Mississippi, by Dr. F. L. RILEY, of the University of Mississippi.
The Growth of Southern Literature since 1870, by Dr. C. A. SMITH, of the University of Louisiana.
Academic Study of Public Aid, Charities and Correction, by J. R. BRACKETT.
Student Cöoperation in Organized Charity, by B. W. ARNOLD, Jr.

October 21.
The Construction of Maps, by E. B. MATTHEWS.
Highways in Maryland, by ST. G. L. SIOUSSAT.
Higher Education in Kentucky, by A. F. LEWIS.

November 3.
The Public Debt of Baltimore, by J. H. HOLLANDER.
Godkin's "Unforeseen Tendencies of Democracy," by T. S. ADAMS.
Hart on "The Historical Opportunity in America," by L. F. SCHMECKEBIER.
Woolsey's "America's Foreign Policy," by C. W. SOMMERVILLE.
Busch's "Bismarck," by C. C. WEAVER.

The Naturalists' Field Club.

December 16, 1897.
Notes on the Botany of Jamaica, by A. FREDHOLM.
Notes on Abnormal Snake Embryos, by V. A. RENOUF.

January 17, 1898.
San José Scale, by E. W. BERGER.
Carrying of young by a Lamellibranch, by G. A. DREW.
Hall's Springs Algae, by D. S. JOHNSON.
Young Sparrow Hawks, by B. W. BARTON.

February 8, 1898.
Regeneration in Cordylophora, by GEO. LEFEVRE.
Curious leaves of Leguminosae, by A. FREDHOLM.

April 19, 1898.
Illustrated Remarks on Jamaica, by M. T. SUDLER.
Netting Wild Pigeons in Virginia, by B. W. BARTON.

May 10, 1898.
Hydra Eggs, by E. A. ANDREWS.

October 11, 1898.
A Colony of Polyzoans, by A. M. REESE.
Habits of Crayfish, by C. E. WATERS.
Habits of Ants, by E. W. BERGER.
Plants found on Ballast Heaps, by C. C. PLITT.
City Water Sediment, by E. A. ANDREWS.
Officers were elected as follows: G. A. DREW, *President*; H. McE. KNOWER, *Vice-President*; W. C. COKER, *Secretary*; M. T. SUDLER, *Chairman Zoological Section*; D. S. JOHNSON, *Chairman Botanical Section*.

Young Men's Christian Association.

October 3.—Opening Reception in Levering Hall to all members of the University.

October 8.—First session of Professor ADAMS' Bible class for the Comparative Study of the Apostolic Church and the Growth of Modern Missions.

October 18.—J. W. BASORE was elected first Vice-President, and J. F. MEYER a member of the Executive Council.

GEOLOGICAL EXCURSIONS FOR THE AUTUMN OF 1898.

The members of the Geological Department have made excursions into the country around Baltimore during the autumn as follows:

October 8. Round Bay and Winchester. Special features: Cretaceous and Eocene deposits, river erosion, ponded and drowned rivers, ripple marks, wind erosion, lignite.
" 15. Bodkin Point and Gibson Island. Special features: Lower and Upper Cretaceous and Pleistocene deposits, lignite, fossil swamps, bar-building.
" 29. Loch Raven. Special features: Archean rocks, Lafayette and Pleistocene deposits, gorge-cutting, lake deposits, superimposed river, decayed crystalline rocks.
November 5. Green Spring Valley. Special features: Quartz schist and stretched tourmaline.
" 12. Jones' Falls and Stony Run. Special features: river erosion.
" 19. School House Hill. Special features: Patapsco and Arundel formations, plant and animal remains.

No. 6, completing Volume III of the JOURNAL OF EXPERIMENTAL MEDICINE, is now ready. It contains the following papers:

HOEN, A. G. On a Form of Degeneration of Striated Muscle met with in the Uvula. Plates XLII–L, - - - - 549
HEKTOEN, LUDVIG. The Fate of the Giant Cells which Form in the Absorption of Coagulated Blood Serum in the Anterior Chamber of the Rabbit's Eye. Plate LI, 573
WORCESTER, W. L. Regeneration of Nerve Fibres in the Central Nervous System. Plate LII, - - - - 579
WILLIAMS, HERBERT U. Experimental Fat Necrosis: The Action of Pancreatic Tissue upon Subcutaneous Adipose Tissue. Plate LIII, - - - - 585
LARTIGAU, AUGUST JEROME A Contribution to the Study of the Pathogenesis of the Bacillus Pyocyaneus, with Special Reference to its Relation to an Epidemic of Dysentery, - - - - 595
MALLORY, F. B. A Histological Study of Typhoid Fever. Plates LIV–LXI, - - 611
HIBBARD, CLEON M., and WHITE, FRANKLIN W. The Leucocytosis of Labor and the Puerperium, - - - - 639
SMITH, THEOBALD. One of the Conditions under which Discontinuous Sterilization may be Ineffective, - - - - 647
HIGGINS, CHARLES H. Notes upon an Epidemic of Fowl Cholera and upon the Comparative Production of Acid by Allied Bacteria, - - - - 651
WEAVER, GEORGE H. Diffuse Sarcoma of the Cerebral and Spinal Pia Mater, - - 669

The Journal of Experimental Medicine is issued bi-monthly. A volume contains at least six hundred pages, with many plates and figures. Subscription $5.00 per volume.

Papers for publication may be sent to the editor, Dr. William H. Welch, 935 St. Paul Street, Baltimore, or to any one of the associate editors. Other communications should be addressed to Mr. N. Murray, Johns Hopkins University, Baltimore, Md.

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The Johns Hopkins University Circulars are issued monthly. They are printed by Messrs. JOHN MURPHY & CO., No. 44 West Baltimore Street, Baltimore. Subscriptions $1.00 a year, may be addressed to THE JOHNS HOPKINS PRESS, BALTIMORE; *single copies will be sent by mail for ten cents each.*

HOURS FOR LECTURES AND RECITATIONS, FIRST HALF-YEAR, 1898-99.

HOURS.	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
A. M. 9	Theory of Functions: Adv. (Craig.) Chem.: Journal Meeting. (Remsen.) Physiology: Journal Club. Solid Geometry: Elem. (Cohen.) Analytic Geom.: Minor. (Hulburt.) Electricity. (Hutchinson.) Palaeontology. (Clark.) French Phonetics. (Armstrong.) English Literature. (Greene.) Descriptive Astronomy. (Poor.) German Readings. (Baker.) Middle High German. (Vos.) Economics and Law. (Sherwood.) French: Elective II. (Keidel.)	Theory of Functions: Adv. (Craig.) Historical Chemistry. (Remsen.) Chem.: Minor. (Renouf and Gilpin.) Chemistry: Major. (Morse.) Latin Composition. (H. L. Wilson.) Italian: Minor. (Rambeau.) German Seminary. (Wood.) Determinants and Calculus. (Hulburt.) Electricity. (Hutchinson.) Experimental Geology. (Reid.) French: Elem. (Armstrong.) Zoology: Major. (Brooks.) Differential Equa. (Cohen.) (8 a. m.) Scientific German. (Baker.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Economic Theories. (Hollander.) Roman Literature. (Smith.) Aristophanes. (Miller.)	Historical Chemistry. Remsen.) Chem.: Minor. (Renouf and Gilpin.) Chemistry: Major. (Morse.) Livy. (H. L. Wilson.) Italian: Minor. (Rambeau.) Old High German. (Wood.) Determinants and Calculus. (Hulburt.) Electricity. (Hutchinson.) Palaeontology. (Clark.) French: Elem. (Armstrong.) Zoology: Major. (Brooks.) Theoretical Mechanics. (Cohen.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Economic Theories. (Hollander.) Epistolary Literature. (Johnston.)	Theory of Functions: Adv. (Craig.) Historical Chemistry. (Remsen.) Chem.: Minor. (Renouf and Gilpin.) Chemistry: Major. (Morse.) Livy. (H. L. Wilson.) Italian: Minor. Rambeau.) German Seminary. (Wood.) Determinants and Calculus. (Hulburt.) Electricity. (Hutchinson.) Experimental Geology. (Reid.) General History Exam. (Ballagh.) Zoology: Major. (Brooks.) Spanish: Minor. (Marden.) Corporations. (Sherwood.) Lucian, etc. (Spieker.) Aristophanes. (Miller.)	Historical Chemistry. (Remsen.) Chem.: Minor. (Renouf and Gilpin.) Chemistry: Major. (Morse.) Livy. (H. L. Wilson.) Italian: Minor. (Rambeau.) German Seminary. (Wood.) Determinants and Calculus. (Hulburt.) Electrical Measurements. (Hering.) Geology: Journal Club. French: Elem. (Armstrong.) Zoology: Major. (Brooks.) Differential Equa. (Cohen.) (8 a. m.) Theoretical Mechanics. (Cohen.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Corporations. (Sherwood.)	Physical Seminary. (Ames.) Experimental Physics. (Waidner.) (9–12.)
10	Greek Seminary. (Gildersleeve.) Electricity and Magnetism. (Rowland.) Physics: Minor. (Ames.) Osteology. (Andrews.) Physiological Seminary. (Howell.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10–5.) Latin Composition. (Smith.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Greek Composition. (Miller.) French Phonology (Armstrong.) Economics. (Hollander.) Mechanics of Engineering. (Geer.) Botany. (D. S. Johnson.) Historical Politics. (Vincent.) Spanish-Amer. Relations. (Callahan.)	Practical Exercises. (Gildersleeve.) Electricity and Magnetism. (Rowland.) Descriptive Astronomy. (Poor.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10–5.) Solid Geometry: Elem. (Cohen.) English Literature. (Greene.) German Readings. (Baker.) Analytic Geometry: Minor. (Hulburt.) French Phonology. (Armstrong.) Lucian, etc. (Spieker) Mechanics of Engineering. (Geer.) Botany. (D. S. Johnson.) Social and Economic Europe. (Vincent.) Middle Dutch. (Vos.)	Greek Seminary. (Gildersleeve.) Physics: Minor. (Ames.) Osteology. (Andrews.) Theoretical Astronomy. (Poor.) Zoology: Adv. (Brooks.) (10–5.) Juvenal. (Smith.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Gothic. (Wood.) Italian Grammar. (Armstrong.) Economics. (Hollander.) Steam Engineering. (Geer.) Latin Composition. (H. L. Wilson.) Spanish Philology. (Marden.) Historical Politics. (Vincent.) Spanish-Amer. Relations. (Callahan.) Syriac. (Johnston.)	Greek Syntax. (Gildersleeve.) Electricity and Magnetism. (Rowland.) Physics: Minor. (Ames.) General Biology. (Andrews.) Theory of Surfaces. (Craig.) Zoology: Adv. (Brooks.) (10–5) Juvenal. (Smith.) French: Major. (Rambeau.) Ancient History. (Ballagh.) French Phonology. (Armstrong.) Economics. (Sherwood.) Steam Engineering. (Geer.) Cicero, etc. (H. L. Wilson.) Botany. (D. S. Johnson.) Social and Economic Europe. (Vincent.) Middle Dutch. (Vos.)	Practical Exercises. (Gildersleeve.) Electricity and Magnetism. (Rowland.) Physics: Minor. (Ames.) General Biology. (Andrews.) Math. Conference. (Craig.) Zoology: Adv. (Brooks.) (10–5.) Juvenal. (Smith.) French: Major. (Rambeau.) Ancient History. (Ballagh.) Gothic. (Wood.) Italian Grammar. (Armstrong.) Economics. (Sherwood.) Steam Engineering. (Geer.) Cicero, etc. (H. L. Wilson.) Botany. (D. S. Johnson.) Spanish Philology. (Marden.) History of Egypt. (Johnston.)	
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2	Spherical Astronomy. (Poor.)	Zoology: Elective. (Brooks.) Drawing. (Whiteman.)	Spherical Astronomy. (Poor.)	Mechanical Drawing. (Geer.) Drawing. (Whiteman.)	Mechanical Drawing. (Geer.)	
3	Hebrew: Second Year. (Haupt.) Old French Readings. (R. H. Wilson.)	Arabic Composition. (Haupt.) Hebrew Composition. (Haupt) (3.30.) English Seminary. (Bright.) Drawing. (Whiteman.) French Syntax. (R. H. Wilson.) Zoology: Elective. (Brooks.) Historical Conference. (Vincent.) (Alternate Tuesdays.)	Hebrew: Elem. (Haupt.) Old French Readings. (R. H. Wilson.)	Mechanical Drawing. (Geer.) English Seminary. (Bright.) Drawing. (Whiteman.) French Syntax. (R. H. Wilson.) Classical Archæology. (Carroll.) Sanskrit. (Blake.)	Arabic: Elem. (Johnston.) Mechanical Drawing. (Geer.) Middle High German. (Vos.) Southern History. (Ballagh.)	
4	Compar. Philology. (Bloomfield.) Compar. Semitic Grammar. (Haupt.)	Biblical Aramaic. (Haupt.) English Seminary. (Bright.) Drawing. (Whiteman.) Historical Conference. (Vincent.) (Alternate Tuesdays.)	Sanskrit. (Bloomfield.) Hebrew: Elem. (Haupt.) Hist. English Grammar. (Bright.)	Comparative Grammar. (Bloomfield.) English Seminary. (Bright.) Economic Seminary. (Sherwood.) Drawing. (Whiteman.) French Conversation. (Teillard.) Mechanical Drawing. (Geer.)	Vedic Seminary. (Bloomfield.) History of Philosophy. (Griffin.) English Journal Club. (Bright.) (Alternate Fridays.) Germanic Society. (Wood.) (Alternate Fridays.) Mechanical Drawing. (Geer.)	

Incidentally it became necessary to prove beyond doubt that these depressions are not due to scarcity of money and cannot be cured by financial legislation. The rationale of the latter argument is so illustrative of Mr. Wells' habits of inductive reasoning that it will justify a short notice.

The first chapter is devoted to a precise description of the depressions which are to be accounted for. The author then proceeds to show that these depressions have been accompanied by an extraordinary multiplication of food, clothing, fuel, machinery, railroads and modes of communication. The great majority of commodities have been 'multiplied with unexampled rapidity and offered for sale at prices unprecedented for cheapness.' Such are the undisputed facts of the case; what is the explanation?

Several popular explanations, *e. g.*, over-production, falling prices, etc., are then examined and shown to be merely different presentations of the phenomenon under investigation, not the causes of the phenomenon. The number of explanations is then narrowed down to two: scarcity of money and improvement in the conditions of production. Of these, the latter is declared to be the true explanation.

With a mastery of detail and an insight into diverse industrial interests that is marvellous, Mr. Wells took up the proof *seriatim*, showing the precise changes which permit more goods to be manufactured now than formerly with the same amount of labor and capital. The phenomenon which the bimetallists claim can only be accounted for by postulating a scarcity of money, is fully explained by the march of invention. The patient investigation is Darwinian in its thoroughness. We must not look for complicated theory or long-spun deduction: the facts are the book. The theory, like the plot of a good novel, can be described in a few words, though this does not mean that keen logical insight is wanting. On the contrary, Mr. Wells demonstrates his logical power by a single chapter on Indian produce, etc., in which he goes to the heart of the currency problem. If scarcity of money is the cause of falling prices, all goods would be affected. The influence of contraction, wrote Mr. Wells, "would have been all-pervasive, synchronous, irresistible and constant as the influence of gravitation." If then there are certain classes of prices which have not been affected, and these refer to those goods whose conditions of production have not improved in the interval under consideration, it is conclusive proof that scarcity of currency is not the explanation desired. In the chapter mentioned above, such a group of prices is shown to exist.

Mr. Wells' economic career began with his paper on "Our Burden and Our Strength," which led to his appointment as Chairman of the National Revenue Commission. Taxation was thus the first economic subject with which he was occupied, and the publication of his "Principles of Taxation," still going on in *The Popular Science Monthly*, shows that this was the last subject with which his mind was busied. In the two other subjects noted, Mr. Wells appears as an advocate, a powerful pleader for the economic philosophy to which he had been converted. But in the "Principles of Taxation" he appears as the constructive scientist with an original system of his own. When we consider the tangled confusion of the subject of finance, in connection with the abilities and opportunities which Mr. Wells possessed, we must be struck with the peculiar untimeliness of the advent of the malady which prevented the perfection, and possibly the completion, of this system of taxation. If order was not wrought from the chaos, our scientific faith is at least strengthened by Mr. Wells' trust in the existence of such an order. I know of no more hopeful note in the recent literature of economics, than that which Mr. Wells sounded with almost passionate reiterance throughout these papers, in behalf of the *science* of finance. These are strange and welcome words from one who was always practical. 'Are these assumptions of economists that there is no science of taxation and no general laws regulating its exercise and effects—assumptions generally concurred in by jurists and popular sentiment—correct? If they are, then there are no principles of taxation to discuss, and a consideration of the subject must be limited mainly to a recital of the world's experiments and experiences and an exposition of legislative enactments and court decisions. To admit their correctness, furthermore, is equivalent to confessing that human knowledge, in at least one department, has reached its extreme limit and that a class of transactions which, more than almost any other, are determinate of the distribution of wealth, the forms in which industry shall be exerted and the sphere of personal liberty, are best directed by accident or caprice."

The positive system of taxation which Mr. Wells would have proposed, is suggested rather than described, in the papers already published in the *Popular Science Monthly*. Until now the treatment has been mair
torical and critical. As these papers have never been formally revie
this Conference, it would seem proper to note here a few of the
principles established.

In the first place Mr. Wells has performed a public service in empl
a thought which prominent authorities seem striving hard to forg
that, whatever the advantages of the faculty theory of taxation, it
recognized in our highest courts, and inconsistent with American dem
The faculty theory may be correct, and socialism may be the ideal
which we should strive; but the two go together, and if one is dan
the other is also dangerous. We are teaching a dubious lesson w
lead a large mass of the people to expect the services of the stat
furnished gratuitously. It is a matter of congratulation to find Mr
deploring, to use his own words, "the almost universal disassociatior
minds of the masses between the payment of taxes and the benefit
fitable return consequent upon such payment."

Mr. Wells has also done good work in protesting against what
the "Monarchical" theory of taxation, the theory that taxation is inh
evil, and that our best plan is to pluck the goose—as Colbert put it
to get the maximum amount of feathers with the minimum am
squawk. This doctrine has found much recognition in our courts
had an immense influence. Mr. Wells cites one case in which
decided that the evidence of a witness could not be debarred me
cause he had been found guilty of perjury in making out his tax li

His antipathy to protective duties, income taxes, and progressive t
in general, is too well known to require any comment. The most dist
principle of his system relates to immaterial wealth, securities, ev
of indebtedness, etc., which he distinguishes from property as shado
substance. Taxation, he claimed, should be upon things; not upon
and not upon the shadows of things. In accordance with his vi
offered the following definition of property, which is, I think,
"Property, at least for the purpose of taxation, is always a physic
ality, with inhering rights or titles, the product solely of labor,
always measured in respect to value and for exchange by labor.
Wells is thus a positive advocate of the Labor theory of value, and
take occasion here to point out, that his money argument in the "
Economic Changes" is valid only on the assumption of the validity
Labor Standard.

Remembering that he believed in the diffusion of taxation and k
in mind the few principles which I have noted, it is easy to see the
towards which his reasoning tends. That result had been enunciate
back as 1874. "The general conclusion," he then wrote, "to wh
investigation seems to lead is, that the rational principle of taxatic
tax but comparatively few articles, namely: visible, tangible prope
fixed signs of property—for in this way only can taxes be assessed equ
uniformly and economically—and then leave them to diffuse, adj
apportion themselves by the inflexible laws of trade and political eco

The manner of Mr. Wells' introduction to economics is well known
interest was first kindled by a living question: the capabilities of
taxation. He may or may not have studied political economy at Wi
but however this may be he has always been regarded—and rightl
practical economist. More than any other writer, perhaps, he und
the actual industrial conditions of the country, and derived his theo
the immense mass of detail which he knew so intimately and handl
such mastery. His work is marked by a maximum quantity of pr
unit of theory; and this statement will, perhaps, sum up as brief
possible the predominant characteristic of his scientific style.

As a public administrator Mr. Wells was marked by unflinching
and unfailing, enthusiastic industry; as a pamphleteer his work wa
acterized by unusual literary and persuasive power; as a scientific eco
he will be remembered for his encouragement and utilization of
mental statistical publications, for his exaltation of fact without depre
of theory, for his consistent devotion to the doctrine of industrial an
mercial liberty.

Mr. L. F. **Schmeckebier**, Fellow in History, spoke of "The
Services of David A. Wells," as follows:

Mr. Wells first came prominently into public notice in 1864, in
year he wrote an essay, entitled "Our Burden and Our Strength,"
resources and debt-paying abilities of the United States. Mr. We

at this time residing in Troy, New York, and the essay was first read at a literary and social club in that city. It was at first privately printed, and was then published by the Loyal Publication Society of New York; and it became one of the most noted publications of the war period, having a circulation in excess of two hundred thousand copies, and being translated into French and German. The essay came at a time when confidence in the government was at a very low ebb. The greenback was quoted in gold at less than half its face value, and the United States bonds had sunk nearly as low. The prospect of further issues of paper and of enormous loans, and the apprehension of a crushing burden of taxation, threatened to close all sources of funds to the government and to force it into hopeless bankruptcy. It was at this crisis that Mr. Wells undertook to show why the nation's credit was still unimpaired and why the national economy was not only able to make good the losses already suffered, but also to be further drawn upon without injury.

This little work made a great impression on President Lincoln, and in January, 1865, he sent for Mr. Wells to come to Washington, to confer with him and Mr. Fessenden, the Secretary of the Treasury, as to the best means of dealing with the debt and the great mass of taxation that the burden of the war had entailed on the country. In March, 1865, Mr. Wells was appointed on the National Revenue Commission together with Stephen Colwell, of Pennsylvania, and S. S. Hayes, of Illinois, Mr. Wells being chairman. The object of the Commission was to inquire into and report on the subject of the best and most effectual way of raising by taxation such revenue as was necessary to supply the wants of the government. The Commission travelled from city to city, and in January, 1866, it presented its investigations to Congress in a valuable and voluminous report, which was subsequently made the basis of the later modifications in the customs and the excise.

For the first time a full and exact statement was made of the curious and complex system of internal and customs taxation which had grown up during the war. During the last six months we have experienced some of the inconveniences of taxation for war purposes, but it is hard to realize the extent of excise taxation at the end of the Civil War. Taxation was, as Mr. Wells said, on the Donnybrook Fair principle of "whenever you see a head hit it; whenever you see a commodity, tax it." Mr. Wells estimated that the government collected between 8 and 15 per cent. on every finished product. Diffuseness was the all-pervading evil of the system, and the Commission recommended "the abolition or speedy reduction of all taxes which tend to check development, and the retention of all those which, like the income tax, fall chiefly upon realized wealth." The report further arraigned the appointment of incapable and dishonest officials, and emphasized the futility of ever hoping for an efficient and economical administration of the system while this method continued. It also contained valuable reports on sugars, tea, coffee, cotton, spices, proprietary articles, petroleum, fermented liquors and distilled spirits as sources of revenue, with estimates of the amount of revenue which the Treasury might expect if taxation on them at various rates was continued. Congress, however, took no direct action on these recommendations; but within three years of the close of the war the most important of them had been substantially adopted, and the most discriminating and oppressive taxes repealed.

At the next session of Congress the office of Special Commissioner of Revenue was created, and Mr. Wells was appointed to this office in recognition of his valuable services as Chairman of the National Revenue Commission. He at once applied himself with great energy to the task of reconstructing and reforming the revenue system. His first report was made in December, 1866. A great deal of valuable statistical material was presented in this report in addition to his analysis of the revenue duties. One of the most important recommendations was that the tax of two dollars a gallon on distilled spirits should be reduced to fifty cents. Not until the session of 1867–68, however, did Congress make this reduction, and the result was one of the most remarkable in all fiscal experience. The total collections rose from eighteen million dollars in the last year of the two dollar tax to forty-five million in the first year of the fifty cent tax, and fifty-five million in the second year.

In 1867 Mr. Wells drew up a bill for the revision of the tariff, which received the hearty endorsement of Secretary McCulloch. Duties on raw materials were reduced and a careful rearrangement was made all along the line. The Senate passed the bill by a vote of 27 to 10. In the House it was necessary to suspend the rules to put the bill on its passage, and the motion to do this was defeated by a vote of 106 to 64, a two-third vote being necessary.

In the same year Congress instructed the Secretary of the Treasury to present at the next session a draft of a new tariff. The task of preparing this bill was turned over to Mr. Wells, as Special Commissioner, and he visited Europe under a government commission for the purpose of studying industry in Great Britain and on the Continent. Up to this time Mr. Wells had been an ardent advocate of the policy of protection. But his investigations in Europe completely changed his views, and led Mr. Wells to an abandonment of his original position, and to his adoption of the belief that free trade, made subordinate to revenue, and tentatively entered upon, was the best policy for the country. It is characteristic of the man, that while he rejected his old protection ideas, yet he realized that free trade must be made subservient to the great fiscal demands upon the government, and also that it must proceed by a gradual process, and that the entire protection fabric could not be swept away at one blow. These views were embodied in his report for 1869, and attracted great attention, both in the United States and in Europe. One of the first acts of M. Wolowski, the French Minister of Finance, after the conclusion of the Franco-Prussian war, was to order the translation and official publication of Mr. Wells' report as Special Commissioner of Revenue for 1869.

In 1870 Mr. Wells retired from his office of Special Commissioner of Revenue. All the important revenue reforms that were adopted by Congress down to 1870 originated with Mr. Wells. These reforms included the redrafting of the entire system of internal revenue laws, the reduction and final abolition of the cotton tax and taxes on manufactures and crude petroleum; the creation of supervisory districts; and the application of stamps for the collection of taxes on tobacco, fermented liquors, and distilled spirits. Mr. Wells also created the Bureau of Statistics, and to the head of this Bureau he called General Francis A. Walker, the assistant editor of the *Springfield Republican.*

On the retirement of Mr. Wells from the office of Special Commissioner, in July, 1870, a large number of members of both Houses of Congress united in a letter to Mr. Wells, of which the following is an extract: "The undersigned, members of the 41st Congress, who have been cognizant of your labor as Special Commissioner of Revenue, take the occasion of your retirement from public duties to express to you their appreciation of the work you have accomplished, and the great ability with which you have discharged the duties of your office. How much soever they may perhaps have differed with you touching the matter of your conclusions on particular points, they desire, nevertheless, to bear testimony to the great value of your work, and to the honesty and the faithful and untiring zeal which have characterized your whole public career." This letter was headed by such Republicans as Sumner, Blaine, Banks, and Edmunds, and such Democrats as Bayard, Thurman, and Randall.

President Garfield, then a member of the House of Representatives, on July 13, 1868, spoke as follows concerning Mr. Wells: "Into the financial chaos resulting from the war Mr. Wells threw the whole weight of a strong, clear mind, guided by an honest heart, and during the last three years he has done more, in my judgment, to bring order out of chaos than any one man in the United States. He has furnished us what we most needed—classified knowledge of the subjects of financial legislation."

Hugh McCulloch, in his autobiography, also paid the following tribute to Mr. Wells: "There are few of my official acts," he says, "that I look upon with more satisfaction than the appointment of David A. Wells to be a Revenue Commissioner. . . . All the reports which were made by Mr. Wells exhibited the most careful, painstaking and intelligent investigation. In clearness and accuracy of statement, and in logical form they have not been surpassed on either side of the Atlantic."

When it became known that Mr. Wells was to retire from his office at Washington, Governor Hoffman, of New York, offered him the chairmanship of the New York State Tax Commission which had been authorized for investigating the subject of local taxation. The other members of this commission were Edwin Dodge and George W. Cuyler. The commission made a most thorough investigation and submitted two reports, together with a code of laws relating to assessment and taxation.

The most important recommendations were that the listing system and the oath which accompanies it should not be used, because of its demoralizing influence, and that intangible personal property should be exempted from taxation, as simply a sign of existing visible property. The commission further recommended a unique experiment in American taxation in that the occupier of every building used as a dwelling or for any other purpose should be taxed, whether the occupier be owner or tenant, on a valuation of three times the rental value of the premises occupied. None of the recommendations of the commission were adopted.

In 1885 Mr. Wells made a trip to Mexico for health and recreation, and as a result there appeared in the *Popular Science Monthly* a series of articles entitled, "A Study of Mexico," which were afterwards amplified and republished in book form. In a little volume of about two hundred pages, Mr. Wells has presented, in an attractive and readable form, the social, economic and political conditions, and the general aspect of Mexico and its relations with the United States. He has done in a small way for our sister republic on the South what Mr. Bryce has done for our own country. Concerning this work, M. Romero, the Mexican minister to the United States, wrote Mr. Wells as follows: "Although I differ with you on several points, and in respect to some of your conclusions, it is surprising to me how well you have understood the condition of Mexico and its difficult problems, especially so far as its relations to the United States are concerned." Rev. George B. Hyde, one of the leading and oldest missionaries of the Methodist Episcopal Church in Mexico, spoke of the "Study" as being the only work "that has not either looked with eyes that saw a paradise or a desert."

Mr. Wells was also successful as a railroad financier and manager, being one of the receivers of the Alabama and Chattanooga Railroad, and one of the reorganizers of the New York and Erie Railroad, and a member of the board of arbitrators of the associated railways of the United States.

Such, in brief, were the main points of what we might call Mr. Wells' public work. Mr. Wells represented the noblest type of American citizenship. A scholarly, painstaking, and conscientious public official; fearless and honest, never pandering to prejudices, nor truckling to obtain the good will of others for selfish ends; dignified and self-constrained even under abuse and calumny, he presents a type of character which should be an inspiration to those who are entrusted with solving the difficult problems of the present and the future.

Brief remarks were also made by Dr. SIDNEY SHERWOOD and Dr. J. H. HOLLANDER.

J. H. H.

THE ALBERT SHAW LECTURES IN AMERICAN DIPLOMATIC HISTORY, 1899.

[NOTE.—Dr. ALBERT SHAW, the founder of this course, received his degree from this University in 1884, after a three years' graduate course in residence. After a few years' editorial connection with the *Minneapolis Tribune*, he became the editor of the *American Review of Reviews*. From 1889 to 1892 he gave annually brief courses of lectures on social, economic and municipal subjects to the students of historical and political science at the Johns Hopkins University. At one time while he was a graduate student in Baltimore, Albert Shaw developed a marked interest in the subject of American Diplomatic History. That interest has endured, not only in the editorial columns of *The Review of Reviews*, but has found academic expression in his recent provision for a course of graduate lectures at his Alma Mater for the years 1899 and 1900 in American Diplomatic History.

For the current year JOHN HOLLADAY LATANÉ, Ph. D., (1895) was appointed "Albert Shaw Lecturer," and he has prepared for publication a course of ten lectures on "The Diplomatic Relations of the United States and Spanish America." In January, 1899, Dr. Latané gave to University students and Baltimore teachers in McCoy Hall three representative lectures: (1) The Spanish-American Revolt; (2) The part played by the United States and England in founding the Spanish-American Republics; and (3) The Diplomacy of the United States in regard to Cuba. Two other lectures were announced on "The Proposed Interoceanic Canal" and "The Monroe Doctrine," but these had to be omitted. The entire course will, however, be published as an extra volume in the Johns Hopkins University Studies. Dr. Latané has been called to the professorship of History in Randolph-Macon Woman's College, Lynchburg, Virginia, where he will repeat his course on the United States and Spanish America, of which a syllabus has been published]

The following is a brief abstract of the three lectures given in Baltimore on the basis of that syllabus. Dr. Latané traced the connection of the United States with our Spanish American neighbors on the South, from the revolt on the mainland in the early part of the present century down to our recent intervention in Cuba. In the first lecture he discussed the colonial system of Spain, the attempted isolation of the colonies from all foreign influence, the restrictions on trade and commerce, and the arbitrary and oppressive character of the government of the Viceroys. He then described the unsuccessful efforts of Miranda, the first South American patriot, to enlist the co-operation of the United States and Great Britain in the work of revolutionizing Spain's American possessions. These efforts, which were somewhat premature, extended over a period of twenty years (1790–1810). Finally, in 1810, in consequence of Napoleon's invasion of Spain and the complete paralysis of Spanish authority, the colonies drifted into revolt in spite of themselves and began the great struggle for independence which was accomplished under the leadership of Bolivar in the North and of San Martin in the South.

In his second lecture, Dr. Latané described the part played by the United States and England in founding the Spanish American republics. The sympathies of the people of the United States were naturally called forth by the infant republics that were but imitating the example of the United States. The growth of British trade with the Spanish colonies during the Napoleonic Wars gave England a distinct interest in the success of the movement. When, therefore, the allied powers of Europe took steps towards intervention in South American affairs with a view to re-establishing Spanish authority, the United States and Great Britain found their interests for the first time in practical accord. Under these circumstances, Mr. Canning suggested a joint declaration, on the part of the two powers whose interests were thus united, against the schemes of the Holy Alliance. This suggestion was not adopted in form by the United States Government, but was followed immediately by the enunciation in the President's Annual Message to Congress (1823) of the principle known as the Monroe Doctrine.

The third lecture was devoted to a discussion of the Diplomacy of the United States in regard to Cuba. The Cuban question was shown to be but the lost chapter in a long history. When the Spanish colonies on the mainland revolted there seemed little reason to suppose that Cuba would long continue a dependency of Spain, and that it did so continue was due to the influence of the United States. When Mexico and Colombia were preparing to aid that island the United States pursuaded them to desist with the hope that Spain might be persuaded to recognize their independence if she could get thereby a guaranty of Cuba. At a latter period, when Spain was still unable to defend Cuba and when British and French designs were feared, the United States Government assured Spain that if she would refrain from a voluntary cession of the island to any other power she might "securely depend upon the military and naval resources of the United States to aid her in preserving or recovering it." Thus in the first half of the century the United States assumed certain responsibilities in regard to Cuba, which led in the second half to the gradual but inevitable evolution of a policy of intervention in the affairs of that island.

SPANISH-AMERICAN RELATIONS.

[Abstract of a course of lectures by Dr. JAMES M. CALLAHAN.]

A course of lectures treating especially of Spanish-American relations and the American policy around the Gulf of Mexico was given to graduate students in the historical department in November and December by Dr. JAMES MORTON CALLAHAN. The part played by Cuba in American history, and the American policy of expansion were the prominent features of the course.

Cuba was a point of departure for early Spanish expeditions for exploration, settlement and intervention in America, a stopping place for treasure ships, a resort for buccaneers, an objective point in the international wars between the European powers that had colonies in the New World, and a place of trade for the American colonists until its capture by an Anglo-American force in 1762. In the American revolution it became a harbor for fleets, by which Spain regained the Floridas while she was seeking to limit the western boundary of the United States to the Appalachians. For many years after the opening of the French Revolution its waters became a theatre of privateering; and as a centre of Spanish rule from Cape Horn to Oregon, it was an aid to designs for limiting American progress and blockading American commerce on the Mississippi. Its destiny has been a subject of frequent consideration since the day that Napoleon ignored the Pyrenees and obtained a deed to Spanish-America. During the Spanish-American revolt, while it was a base for hostile expeditions against Mexico and Colombia, with its people contemplating independence, its slaves suspected of being on the eve of an insurrection, and its shores infested by marauding pirates, its fate became doubly uncertain and attracted the eyes of the nations. Its future was considered in connection with the events which gave rise to the Monroe doctrine, and at several times

after propositions were made looking toward a guarantee to prevent the
d from falling into the hands of any nation except Spain. For many
after 1830 it was a source of Anglo-American jealousies, and the con-
n of parties in Spain together with rumors of foreign designs caused
Jnited States practically to guarantee the island to Spain by announc-
hat force would be used if necessary to prevent its transfer to any other
pean power. Its political significance was increased by the results of
Mexican war, and from 1848 until the sounding of the alarm gong of
American civil war it was continually a subject of international nego-
on, and of disputes, which induced many (especially in the South) to
a policy of acquisition by the United States. Both parties to the civil
disclaimed any designs to acquire the island, even when the compli-
ns which arose around the Gulf during that war several times suggested
eed of a United States naval station in the West Indies. With the
of that war there was no longer any inducement to cause any party to
the annexation of the island in order to extend slavery, but President
t, with an expressed desire to settle the race question at the South,
mplated the annexation of San Domingo as a home to which freed-
could emigrate.

ter the civil war Cuba was almost continuously in a state of open or
ressed insurrection against its anomalous condition under Spanish rule,
Europe recognized that the United States showed a remarkable patience
forbearance with the constant inconveniences at her front door, which
rendered more irritating by Spanish diplomatic delays and procras-
ions.

e recent American intervention was but the logical conclusion of
st a century of American history. Since the administration of Jeffer-
he government at Washington has always manifested a great interest
e welfare of Cuba, and, while opposing the intervention of other
rs, and offering friendly mediation, has contemplated the possibility
igencies which might arise to make American intervention a neces-
or a duty.

e following is a list of the topics treated by Dr. Callahan:

Anglo-Spanish relations around the Gulf before 1783.

The struggle of a growing West against the Spanish attempt to
ade the mouth of the Mississippi.

The Florida question, and Cuba's relation to it.

The Spanish-American revolt, and Anglo-American relations. Cuba
mes "the Turkey of transatlantic politics."

International jealousies in Cuba and Texas, and the result of the
with Mexico.

"Manifest destiny," and American opposition to circumscription.

Foreign policy of the Pierce administration. Negotiations to obtain
—by the purse if possible.

Territorial policy of the Buchanan administration.

Influence of American disunion and reunion upon international
ions.

. Origin and development of the American policy of intervention
uba.

. Review of American territorial and colonial policy.

JAMES BLAIR (1656–1743).

stract of a paper read before the Southern History Conference and in the Historical
olitical Science Association, by D. E. MOTLEY.]

mes Blair was born in Scotland in 1656 and was graduated from Edin-
h University with the degree of Master of Arts in 1673. For several
he was rector of Cranston Parish. He then went to England in the
r part of the reign of Charles II., where he attracted the attention of
Compton, Bishop of London, who persuaded him to come to Virginia
issionary. He sailed to Virginia in 1685, and in the same year became
ster at Henrico City, where he remained till 1694, when he moved to
estown and took charge of the parish there. In 1710, he became rector
ruton Church at Williamsburg and remained its parish minister till his
h in 1743. Four volumes of his sermons were published in 1722.
are among the oldest works in the field of American religious
ature.

1689, Dr. Blair was appointed Commissary in Virginia by the Bishop
ondon, being the first Commissary sent to that colony. The Commissary exercised nearly all the functions of a Bishop except ordination and the probating of wills. Dr. Blair continued in the office of a Commissary until his death. He disciplined the clergy, looked after their education and endeavored to supply vacant parishes with ministers, for it was a most difficult task to get good clergymen to come to the colony. When Dr. Blair was appointed Commissary there were fifty parishes in Virginia and only twenty-two preachers, but by 1733, there were only two vacant parishes in the colony.

For fifty years, Dr. Blair was one of the most influential members of the Council of Virginia, and during part of this time, was its President. His educational work was most important. When he came to Virginia there were in that colony only "one privately endowed public school and a few old field schools." Several attempts had been made to establish a college, but, owing to the many obstacles to educational projects in those days of beginnings, the attempts failed. In trying to raise the standard of the ministry, Dr. Blair saw most clearly and felt most keenly the need of a college. Encouraged by Governor Nicholson and some of the clergy, he set himself to the task of founding a college. In 1691 he went to England, and obtained a charter. Then he returned to Virginia and founded the College of William and Mary in 1693. By the charter and also by the act of the General Assembly of Virginia, Dr. Blair was made President of the College and this office he held till his death. For several years, owing to the lack of money and the contemptible factions ever present in the colony, the College was not much more than an ordinary school. But Dr. Blair persisted in the work with an indomitable will and by 1730 the College had grown to the size contemplated by the charter. The classical and oriental languages, divinity and mathematics were now taught. There were six professors. William and Mary College not only educated many of the most renowned men of Virginia, but also some of the greatest statesmen of the American Republic. William and Mary College is an historic and living monument to the memory of the Reverend James Blair.

BALTIMORE AND MUNICIPAL REFORM.

[Abstract of remarks before the Historical and Political Association, January 26, 1899. By J. C. BALLAGH.]

Modern governmental reform in general, and particularly in America, has been structural rather than functional. This tendency may imply widespread pessimism as to the political uprightness of human nature, but it is logical and practical in proceeding from the known to the unknown and from the politically safe and attainable toward ideals. Organs of government properly constructed are a valuable check upon the methods of "the machine." We are not governed by charters and codes but by men *through* charters and codes and the capabilities of the instrument are important. The new Baltimore Charter stands as the final step in a long series of organic reform which is essentially modern. Reform is a slow but sure evolution. From the municipal reforms of Stein in 1808, to the Kreisordnung of 1872, Prussia has been evolving a new theory of her local government. Municipal reform in Great Britain, extends from 1835 to 1882, and 1888, and in the United States, from 1789 to the present day. The local liberties of France date from 1884. European reform has been mainly external in cause and effect as respects the city. American reform is internal. While European cities are still under council government the most progressive cities of the United States have gone over to the form of government by a responsible Mayor. Baltimore like most of our large cities has passed through all the stages of progress to this idea. Speaking generally for the United States, there have been four of these stages in our reform history; (1) 1789–1822,—a revolt from colonial legislative and executive control to self-government by citizen representatives in council; (2) 1830–1855,—reform in a democratic direction to a responsible elective executive with a separation of the subordinated executive from legislative powers; (3) 1860–1871,—attempted protection of cities, by constitutional and statutory limitations upon their powers, from the ill effects of the combined commission and council system which supported boodle scandals and rings, and from the follies of special legislation; (4) 1871–1898,—concentration of power and responsibility in the executive, narrowing it to individual responsibility and restricting the interference of both city and state legislatures. Baltimore has made the transition with less scandal than most other cities. Though rings existed, nothing comparable to the operations of Tweed, the Philadelphia Gas Ring, or Boss Shepherd in Washington have been unearthed. The new Charter brings Baltimore, in common with Boston, Philadelphia and Greater New York, into line with the Brooklyn idea. The plan of a responsible Mayor was first suggested by Chicago in 1875, and but for fear of a repetition of Tweed's methods the plan might have been known as the Chicago idea. The charter movement in Baltimore was made possible by certain local conditions: (1) A political revolution in state and city carried by independents for reform. (2) "Litigation growing out of disputes between the Mayor and the City Council and the Mayor and the School Board based upon conflicting construction of our ancient city charter." (3) A greater Baltimore, twice the area of ten years ago with a growing population now over half a million, for which the existing charter was unsuited and antiquated. (4) The contagious experience of other progressive cities like New York. But the impelling force that created and focused public sentiment was the press of Baltimore, especially the Baltimore Sun through its late city editor Mr. Dashiell, and to him and his staff great credit is due. From May 10 to Nov. 26, 1897, strong pleas were made almost daily through either the editorial or local columns of this paper, bringing to bear the best views and influence of representative citizens in the demand for a revised form of government. Thus resulted the ordinance for the appointment of a charter commission, drafted by Mr. Thomas I. Elliott for the City Council in September, which became a law on the 24th of November. The commission appointed on the following day was remarkable both for its work and its personnel. Small in number, the commission comprised only eight members as contrasted with eleven chosen in Philadelphia, and fourteen in New York for similar duties. The Baltimore commission was representative, professionally, politically and socially, but it was in the highest sense non-partisan and practical. These men trained in public service, education, law and business with diverse talents, opinions and interests, serving without pay, as a labor of love, at once found themselves in substantial accord on the general principles of reform; that municipal affairs should be separated as far as possible from state and national politics, that power and responsibility should be concentrated in the executive, that the city's finances should be protected from raid and fraud. Their work was both specialized and co-operative. They drew from the past experience of Baltimore, from prior suggestions for local reforms, from the recent experience of progressive cities and the advice of their citizens as well as of Baltimoreans, and from the general theory of American municipal reform. The plan was to save what was good from the old system and to engraft upon it the best features proved practicable by modern experience. The public was taken into confidence and co-operation was invited. No measure was adopted without unanimous consent. Some compromises were involved but no great principle was wholly sacrificed. A few deficiencies and omissions have since appeared which may be remedied, but it is remarkable that they were so few in the necessary haste of preparing the bill. Probably no case is on record where the organic law of a great city has been reconstructed in so short a time. Four months to a day from the time the Mayor signed the Charter ordinance the Governor of the State signed the Charter act. (Nov. 24, 1897, and March 24, 1898.) The bill was drafted in all of its essentials in slightly more than two months. During its brief stay of three weeks in the legislature it was most skillfully managed by its sponsors, who were beforehand with the opposition there as previously in the case of the City Council, so that the bill never got definitely into politics to be seriously mutilated. All told it cost nearly $250 less than the $5000 appropriated by the Council. Baltimore like Boston received her reform charter from the hands of the legislature without any further test of popular approval than public sentiment expressed through the press, the validity of which is affirmed in the echo of general satisfaction. It now remains her higher duty to select clean men to put in operation this clean charter. No store-house can be so well built as to keep out all the "rats." The present movement for good nominations equals, if not surpasses, in importance charter reform, to which it is but a fitting sequel.

THE TOCQUEVILLE MEDAL

REGULATIONS FOR 1899–1900

I.

The Tocqueville gold medal is annually offered by the "*Union Française des Universités d'Amérique*" to that member of the Johns Hopkins University, who shall have written the best essay on some subject illustrating any phase of French history, political or social, from 1815 to 1890, or a review of some important historical work published in France since 1890.

II.

The medal is given in honor of the illustrious Frenchman, Alexis de Tocqueville (1805–1859), author of the well-known historical and political studies, "Ancien Régime" and "Démocratie en Amérique."

III.

Subjects like the following are recommended: (1) Origin of the Second Republic; (2) Evolution of France under the Third Republic; (3) France in Asia; (4) France in Africa; (5) France in Canada or Louisiana; (6) Education in France; (7) Characteristics of French Civilization; (8) The Services of a French Historian or Statesman, for example, Tocqueville, Guizot, Thiers, Lamartine, Gambetta, Taine, Levasseur, Leroy-Beaulieu.

IV.

Such an elaborate essay as that required for a Doctor's dissertation is not expected, but rather an academic study of modern French history, politics, economics, or social science. Absolutely new and original contributions to French contemporary history can hardly be made in America, but the knowledge of the subject and of its recent literature can be encouraged and promoted.

V.

The "*Union Française des Universités d'Amérique*" is a patriotic Society formed in Paris for the purpose of extending in this country an acquaintance, among college and university men, with French education and civilization. Among the members of this Society are Paul Bourget, of the French Academy, the Duke de Noailles, the Viscount de Tocqueville, the Count de Rochambeau, and the Count Jacques de Pourtalès. Baron Pierre de Coubertin is the President of this French Society, and, on its behalf, offers the Tocqueville Medal as a peculiar and distinguished honor to the Johns Hopkins University.

VI.

Essays must be either printed, legibly written, or typewritten (on one side only of ordinary thesis-sized paper). Not less than 8,000 or more than 16,000 words are desired. Papers must be sent, in completed form, to the Registrar of the University before May 15, 1899, or before February 1, 1900.

VII.

The Award will be made by authority of the Academic Council either on Commencement Day, about the middle of June, or on Commemoration Day, the twenty-second of February.

MARCH, 1899.

Of the Seventeenth Series (1899) of the STUDIES IN HISTORICAL AND POLITICAL SCIENCE, Nos. 1–2–3, **HISTORY OF STATE BANKING IN MARYLAND** by A. C. BRYAN is now ready. Price $1.00. The following numbers are in press or in preparation for early issue.

III-IV. History of the Know-Nothing Party in Maryland. By L. F. SCHMECKEBIER.
V. History of Slavery in North Carolina. By J. S. BASSETT.
VI. History of Slavery in Virginia. By J. C. BALLAGH.
VII. The Labadist Colony in Maryland. By B. B. JAMES.
VIII. The Separatists of Zoar. By GEORGE B. LANDIS.
IX. Early Development of the Chesapeake and Ohio Canal Project. By GEORGE W. WARD.

Other numbers will be announced from time to time.

TEACHERS' LECTURES AT THE JOHNS HOPKINS UNIVERSITY, 1898-99.

Preliminary statements regarding the Teachers' Courses, both Scientific and Historical, were made in the University *Circulars*, Nos. 137 and 138. Both courses are now so far advanced, indeed so near completion, that it is possible to report results. A striking feature of the experiment was the large and regular attendance. There were in each course two grades of hearers: (1) Members of the "Class," who paid each a fee of $5, and who do a certain amount of required reading and class work; and (2) simply attendants on lectures, who paid each an admission fee of $3. Of the first grade, or regular members, there are in the Historical Course 117; in the Scientific Course 111. Of the second grade there are 191 attendants on the historical lectures, and 115 attendants on the scientific lectures. The total number of hearers in Science are 226; the total in History, 308. Records of attendance were kept from week to week for the classes only. In spite of continued cold and inclement weather, the regular members of classes were almost invariably present. Every Friday night, at 8 o'clock, in McCoy Hall, and every Saturday morning, at 9.30, a large and attentive audience greeted the lecturer.

I. The Historical Course.

A special feature of the historical course was the written exercise required from week to week, in answer to printed or set questions connected with the previous lecture. These exercises involved not merely an understanding of the lecture, but, in some cases, a considerable amount of private reading. The questions, few in number, led to original inquiries in the Peabody and Pratt Libraries and to the exercise of independent judgment. The answers, which sometimes amounted to a series of short essays on assigned themes, were always carefully scrutinized by the lecturer or his assistants, and were returned to the writers with the needed corrections or suggestions. The papers were marked in the same general or descriptive way as that now in vogue in the collegiate departments of the University, and the results from week to week showed that by far the greater number were ranked above the grade called "good." From time to time the names of the five leading members of the Historico-Educational class were publicly mentioned by the lecturer. To encourage the best students, a prize was offered at the beginning of the above course.

Another feature of the Teachers' Lectures was the illustration of the subject-matter by lantern-views. Instead of subordinating the lecture to mere sight-seeing or evening entertainment, the illustrations were usually given *after* the lecture and were always contributory to it. About 50 minutes were allowed for the lecture and note-taking, with about 20 for the slides, which furnished an instructive and pleasing variation of the lecture-theme. These object lessons were in all cases carefully selected by the lecturer and served a really pedagogical purpose.

A third feature of the Historico-Educational course was the systematic publication of select bibliographies of good books on the themes suggested by the lecture-outlines, which were printed and taken home by the teachers from week to week, with the printed questions and topics for home study. This naturally led to considerable use of the library resources of Baltimore and to the practical discovery that the available literature on educational history is somewhat inadequate. There is manifest need of a good working library in this city for the investigation and promotion of educational interests, primary, secondary, and higher. Many complaints were made by Baltimore teachers regarding the impossibility of obtaining access to the books recommended in the select bibliographies.

A fourth and very noteworthy feature of the Teachers' Lectures was the public interest in them shown by the teachers themselves, by university students, the public, the press, the Superintendent and Commissioners of the Public Schools of Baltimore, many of whom were present from time to time. Already requests have been made for the continuation and further development of these courses of public instruction, which tend to promote mutual sympathy and understanding between the University and the City, and also between teachers, public, private, and academic. As a profession, the teaching class is really one in spirit and, in Baltimore at the present time, all should unite in promoting the common cause of education. A graduate of the University, Dr. S. E. Forman, has been appointed Director of the Teachers' Institutes of the State of Maryland and, after conducting sessions in various counties of Maryland, gave, March 10, a helpful lecture on "Learning to Teach," in the Historico-Educational course of the University.

Besides the lectures on Educational History mentioned in the December *Circular*, 1898, two historical lectures were given by Dr. William Cunningham, of Trinity College, Cambridge, on (1) "English Country Life in the Middle Ages" and (2) "English Towns in the Middle Ages." A very interesting illustrated talk on "The Land of Shakespeare" was given by Albert H. Smyth, Professor of English, Central High School, Philadelphia, who received his Bachelor's degree at the Johns Hopkins University. Two other graduates of this institution, Dr. Guy Carleton Lee and Dr. Bernard C. Steiner, both now teachers in the historical department, contributed each a course of four lectures. That of Dr. Lee was upon the general subject of "The English Beginnings of American Institutions," with the following specific subjects: (1) First English Settlement in America; (2) English and Colonial Churches; (3) English Law and Government; (4) The Conflict of England and France in America. Dr. Steiner's four lectures on "American History" will be concluded on the 14th of April. His special themes are: (1) American Geography and American History; (2) Causes of the American Revolution; (3) The Adoption of the Federal Constitution; (4) The War of 1812.

In addition to these lectures, which formed part of the regular Historico-Educational course, the following special courses were offered, without extra charge, to the Public School Teachers holding tickets to the Historical Section: (1) Eight lectures, in January and February, by Dr. James Schouler, on "The Industrial History of the United States;" (2) Five lectures on "The Diplomatic Relations of the United States and Spanish-America" (reported in this number of the University *Circulars*. See p. 38), by Dr. John H. Latané, Professor of History in Randolph-Macon Woman's College, and "Albert Shaw Lecturer" in this University for 1899. These two special courses were given respectively in the Donovan Room and McCoy Hall on alternate days at 5 p. m. The attendance, although gratifying, showed that the 5 o'clock hour is not so convenient for public school teachers as an evening appointment at eight o'clock.

In connection with the regular Historico-Educational Course, one of two recommended text-books was required, either Compayré's "History of Pedagogy" or Painter's "History of Education." This private reading, together with the substance of the educational lectures, will constitute the basis of the proposed written examination at the end of the course. In addition to this work, and the various written exercises, a more elaborate essay is required upon some special subject suggested by the lectures, either historical or educational. Prizes in books will be offered for the best three essays. A simple certificate has been prepared for those members of the class whose final examination, required essay, written exercises, and attendance are pronounced satisfactory by the examiner.

H. B. A.

II. The Scientific Course.

The teachers attending the Scientific Course are concentrating their attention, during the present year, on studies in Geology and Physical Geography. In this course four lines of instruction are followed. These are first, the lectures; second, essay writing; third, the journal club; and fourth, field excursions.

The lectures are delivered on Saturday mornings at 9.30 in McCoy hall and are scheduled so as to cover systematically a large range of topics in Dynamical, Physiographical and Historical Geology and Physical Geography. The following is a synopsis of the lecture course: November 5, The Atmosphere; 12, Rain; 19, Rivers in General; December 3, Classification of Rivers; 10, The Life History of Niagara and the Development of the Great Lakes; 17, Lakes; January 7, Ice in General; 14, Glaciers; 21, Geological Work of Organisms; 28, Oceans; February 4, Volcanoes; 11, Mountains and Continents; 18, Geographic Distribution of Organisms; 25, Paleontology; March 4, Precambrian Time; 11, Cambrian and Silurian Time; 18, Devonian, Carboniferous and Permian Time; 25, Mesozoic Time; April 8, Tertiary Time; 15, Quaternary Time. The subject matter of these lectures has been treated so as to convey a comprehensive idea of the various forces at work on the earth's surface and within its mass, as well as to give a broad outlook over the history of the earth as a whole.

From time to time essays have been assigned, on special topics discussed in the lectures, in order that the instructor may follow more carefully the progress of those participating in this exercise. These essays are carefully examined in detail and corrections and suggestions made wherever necessary.

References and bibliographies, which have been printed and circulated, have both aided the teachers in preparing their essays and served as a guide for those who desire to read some of the leading works on geology and geography.

The journal club has been held Tuesday afternoons throughout the months of December, January, February and March. The teachers who have taken part in this exercise have reviewed papers on geological and geographical subjects which are published in the various scientific periodicals. During the four winter months a large number of books and papers have been reviewed and discussed in the club and the desire of keeping abreast of the current literature has thus been cultivated.

Numerous geological excursions, into the region about Baltimore, have been planned and will begin as soon as the weather permits. The object of these excursions is to point out in the field many of the phenomena which have been discussed in the lectures. Explanations will be given in the field and the teachers are expected to provide themselves with hammers and notebooks in order to collect specimens and record observations. Many of the teachers will in this way be placed in a position to conduct small excursions of school children into the country on pleasant holiday afternoons and point out to them the meaning of the objects with which every-day-contact has made them familiar.

A longer excursion is projected to Niagara Falls which will take place as soon as the schools close in the summer. This excursion will take the form of a scientific expedition and many points of interest other than Niagara will be visited.

Professor William B. Clark has exercised general direction over the course, while the instruction has been given by Dr. George B. Shattuck. Mr. Bailey Willis, of the United States Geological Survey, delivered a most instructive lecture on "Mountains and Continents."

G. B. S.

Degree of Doctor of Philosophy.

In response to an inquiry respecting the amount of time actually spent in the Johns Hopkins University by candidates for the degree of Doctor of Philosophy, the following statistics have been prepared, respecting those who received the degree in 1898. Statistics for previous years would probably differ immaterially.

The degree was conferred in 1898 upon 36 candidates.

Nineteen (19) had resided here but 3 years. All of these had been out of college 4 years or more, many of them having devoted at least 1 year to graduate work elsewhere.

One (1) had resided here 3½ years; six (6), 4 years; three (3), 5 years; one (1), 5½ years; two (2), 6 years; one (1), 7 years (interruptedly).

Three (3) had resided here only 2 years; but all of these had spent 1 year or more in graduate study elsewhere, and only one (1) had been out of college less than 4 years.

Wehrhane Memorial Lectureship.

A lectureship to treat of German literature, history and art has been instituted in this University by the generosity of Mr. J. B. Noel Wyatt, of Baltimore, who thus commemorates the name of his friend, the late Mr. William Henry Wehrhane.

The first course of lectures on this foundation was given by **Kuno Francke**, Ph. D., Professor of German Literature in Harvard University, and author of "Social Forces in German Literature," "Glimpses of Modern German Culture," etc.

The subject was "Certain Phases of Flemish and German Religious Painting of the Fifteenth and Sixteenth Centuries."

The special subjects treated were: —

The Ghent Altar of the Brothers van Eyck;—Rogier van der Weyden;—Hans Memlinc;—Masters of the Rhenish, Franconian, and Swabian Schools;—Dürer's Biblical Illustrations;—Holbein's Dance of Death.

THE TWENTY-THIRD COMMEMORATION DAY.

The annual commemoration day of the University was observed on Wednesday, February 22, 1899.

The public exercises were held in McCoy Hall at eleven o'clock. The trustees and faculty, accompanied by their guests and escorted by the students, entered the hall in procession headed by the President of the University and the Governor of the State.

The prayer was offered by the Rev. J. Houston Eccleston, S. T. D., of Baltimore.

An address on the History and Prospects of the Johns Hopkins University—commemorating the twenty-fifth anniversary of the first meeting of the Trustees after the death of the Founder—was delivered by President Gilman.

The degree of Doctor of Philosophy was conferred upon the following persons:

James Rees Ewing, of Granville, O., A. B., Ohio Wesleyan University, 1890. His subjects of study were History, Politics, and History of Philosophy. His dissertation is entitled "The Public Services of Jacob Dolson Cox, of Ohio." The referees on the dissertation were Professors Adams and Vincent.

George Philip Krapp, of New York City, A. B., Wittenberg College, 1894. His subjects were English, French, and German, and his dissertation is entitled "The Legend of St. Patrick's Purgatory, with a text of the Vision of William Staunton." The dissertation was referred to Professors Bright and Browne, and Dr. F. M. Warren.

Walter Alexander Montgomery, of Raleigh, N. C., A. B., Johns Hopkins University, 1892, whose subjects were Greek, Latin, and Sanskrit. His dissertation, which was referred to Professors Gildersleeve and Spieker, is entitled "Dio Chrysostom as a Homeric Critic."

Mervin Tubman Sudler, of Westover, Md., S. B., Maryland Agricultural College, 1894. His studies were Zoology, Physiology, and Botany. His dissertation is entitled "The Development of the Summer-eggs of Penilia ——?", and was referred to Professors Brooks and Andrews.

The degree of Bachelor of Arts was conferred upon the following candidates:

Albert Charles Dieffenbach, of Baltimore.
Leonard Keene Hirshberg, of Baltimore.
Powhatan Johnson Wooldridge, of Louisville, Ky.

Two portraits presented to the University were unveiled: the one, of Professor Remsen, by R. G. Hardie, the gift of a number of Professor Remsen's associates, friends, and pupils; the other, of Professor Sylvester, by Harper Pennington, from an anonymous donor. The formal presentations were made by Dr. Gilpin and Professor Newcomb respectively.

Announcement was made that the Turnbull lecturer next year would be Dr. H. S. Chamberlain, the biographer of Wagner—his subject being "Wagner as a Poet." It was also announced that Professor Paulsen, of Berlin, would deliver a series of lectures on education.

Music was rendered during the exercises by an orchestra, conducted by Mr. Edwin L. Turnbull, of the class of 1893, and by the University Glee Club conducted by Mr. K. Jungbluth, Jr.

A meeting of the Alumni Association was held in the morning in McCoy Hall. Officers were elected as follows:—

President, Paul J. Dashiell, A. B., '87, and Ph. D., '91; Secretary, A. J. Shriver, A. B., '91; Treasurer, Henry Oliver Thompson, A. B., '87; Executive Committee, J. S. Ames, A. B., '86, and Ph. D., '90, A. R. L. Dohme, A. B., '86, and Ph. D., '89, W. S. Hilles, A. B., '89, J. L. G. Lee, A. B., '93, and T. Fitzgerald, Jr., A. B., '98.

The annual alumni dinner was held at Hotel Rennert in the evening. Addresses were made by President Gilman, Rev. M. D. Babcock, Professor William Osler, Professor H. B. Adams, and others.

Levering Lectures.

The course of lectures before the Young Men's Christian Association of the University, annually provided by Mr. Eugene Levering, were delivered this year by the Rev. William N. Clarke, D. D., Professor of Christian Theology in Colgate University. His subject was "Three Gifts of Christ: The Christian People; the Christian Doctrine; the Christian Power." The lectures were given in Levering Hall, March 16, 17, 20.

PROCEEDINGS OF SOCIETIES.

Association.

44, 45.

al Association.

16, 1898.—One hundred and seventieth regular meeting. Thirty-six members present.

ad:

ative Conjunctive Relations, by R. H. Wilson.
unt of Poitou and the Count of Toulouse,—an Incident in the Poema de
an Gonzalez, by C. C. Marden.

0, 1899.—One hundred and seventy-first regular meeting. Thirty-four mem-
were present.

ad:

storical Development of the Types of the First Person Plural Imperative in
ian, by W. Kurrelmeyer.
rysostom as a Homeric Critic, by W. A. Montgomery.

17.—One hundred and seventy-second regular meeting. Fifty-two members present.

d:

logical Comments on Ezekiel, by P. Haupt.

l and Political Science Association.

17, 1898.
e of Commissary James Blair, William and Mary College, by D. E. Motley.
on in Maryland, by T. S. Adams.
Literature on the Philippine Islands, by W. S. Myers.
on's "Spain in History," by W. S. Drewry.
ns on "Anglo-Saxon Superiority," by Robert Garrett.
rs' "Modern Europe," by W. T. Thom.

1.
blic Services of Jacob Dolson Cox, by J. R. Ewing.
"History of Education in New Hampshire," by E. T. Dickerson.
shoda Question, by C. W. Sommerville.
iberty and Free Soil Parties in the North-west," by O. J. Marston.
History of Education in Louisiana," by D. E. Motley.
"Life of Napoleon III.," by G. L. P. Radcliffe.

15.
rcial Prospects of the Philippines, by O. J. Marston.
licy in the Philippines, by E. T. Dickerson.
n's "Modern Political Institutions," by St. G. L. Sioussat.
on on the "Historical Methods of Froude and Freeman," by R. D. Miller.
"Recollections of the Civil War," by J. W. R. Sumwalt.
t's Government of Federal Territories in Europe," by H. Campbell.
"Control of the Tropics," by C. C. Weaver.

12, 1899.
ry in Virginia," by J. C. Ballagh.
"Rise and Growth of American Politics," by J. N. Atkinson.
"Empire and Papacy," by J. R. Ewing.
on "The Newspaper Press," by W. S. Myers.

26.
w Charter of Baltimore, by R. D. Miller.
ss of Municipal Reform in Baltimore, by J. C. Ballagh.
ion of the New Charter, by Doctors Sherwood, Vincent, Willoughby, and
ander.
"American History as told by Contemporaries," by W. S. Drewry.
Cuba and Porto Rico," by W. E. Martin.
's "Constitutional History," by J. C. Tyler.

17.
nks of England, France, Germany, and the United States, by H. Campbell.
y of Forty Families in Baltimore, by B. W. Arnold.
od's "History of the Presidency," by V. A. Renouf.
"History of the Netherlands," by P. L. Groome.
f a Hopkins Graduates' Club, by H. B. Adams.

y of Colonial Highways, by St. G. L. Sioussat.
e's "Personal Recollections of A. Lincoln and the Civil War," by C. E.
inger.
oun's "Nicaragua Canal," by V. A. Renouf.
ns' "With Kitchener to Khartum," by W. S. Myers.
worth's "South America," by W. J. Boggs.
s "Cuba," by C. Snavely.
Middle America Peopled from Asia," by W. T. Thom.

BLIC MEETINGS AND SOCIAL ASSEMBLIES

eld in the University buildings:

by the Johns Hopkins Musical Association, in McCoy Hall, December 10 and
y 14, and a lecture by Professor Ames on Acoustics, February 11.
dances, in McCoy Hall, December 23, January 7 and 21, February 4.
meetings of the Baltimore Folk-Lore Society, in the Donovan Room, Decem-
January 27, February 24.

or Simon Newcomb, LL. D., F. R. S., Professor of Mathematics
onomy, is giving conferences on selected topics in the field of
tics and Physics. They are open to advanced students of the
ty, and are addressed to those whose previous studies in scientific
may interest them in the broad aspects of mathematical and astro-
investigations.

ecial subjects are:—

velopment of the scientific habit of thought. Historic retrospect
ginnings of modern Science, and of the habit of accurate thinking
oning;—The fundamental concepts of Physics as they cluster
he question of *actio in distans*;—The concepts of transcendental
r;—The teaching of elementary Mathematics;—Recent advances
eal Astronomy;—The functions of Government in advancing

Professor W. K. Brooks's lectures on "The Foundations of Zoology," given here last Spring and later at Columbia University, have just been issued as a volume of the Columbia University Biological Series by the Macmillan Company, of New York.

Professor F. M. Warren (Ph. D., J. H. U., 1887), of Adelbert College, gave a course of eight lectures on "Realism and Naturalism in French Literature," January 24 to February 9, in the Donovan Room.

Professor James Schouler gave eight lectures on the "Industrial History of the United States," in the Donovan Room, January 23 to February 15.

A. Mitchell Carroll (Ph. D., J. H. U., 1893), gave a course of twelve lectures on Classical Archaeology, October 13 to December 15. He also gave a course on the same subject in the Peabody Institute during the months of January and February.

The Fourth Series of American Lectures on the History of Religions was given here December 5-12, by Professor Karl Budde, D. D., of the University of Strassburg. The course consisted of six lectures and was devoted to "The Religion of Israel from the Earliest Times to the Exile."

At the annual meeting for 1898 of the American Academy of Arts and Sciences, the Rumford Medal of the Academy was awarded to Professor James E. Keeler (A. B., J. H. U., 1881), now Director of the Lick Observatory, in recognition of his application of the spectroscope to astronomical problems, and especially of his investigations of the proper motions of the nebulae and the physical constitution of the rings of the planet Saturn, by the use of the spectroscope.

There was a public debate and prize contest in public speaking, by undergraduates, on the evening of Wednesday, March 15, 1899, in McCoy Hall. The classes of 1899 and 1900 engaged in a prize debate, and members of the class of 1901 contested for a prize for excellence in speaking.

Enlargement of the American Chemical Journal.

In consequence of the large amount of material sent in for publication, it is deemed necessary to increase the size and the number of issues of this Journal. It will hereafter appear monthly. Two volumes, of six numbers and of about five hundred pages each, will be issued yearly. The subscription price *per year* will be five dollars.

Renewals of subscriptions to the volumes for 1899 will be accepted at the old rates. New subscriptions for 1899 and all subscriptions to subsequent years will be charged as above.

The Journal will contain as heretofore, original articles mostly by American chemists; reviews of works relating to chemistry; reports on progress in the various departments of chemistry; and items of general interest to chemists.

THE FOLLOWING NEW EXTRA VOLUMES OF THE

STUDIES IN HISTORICAL AND POLITICAL SCIENCE

ARE IN PREPARATION FOR EARLY PUBLICATION.

The Financial History of Baltimore. By J. H. Hollander, Ph. D.

This work is probably the first exhaustive study of the financial history of an American city. The author traces in detail the development of municipal expenditure revenue, indebtedness and financial administration through the several periods of pre-corporate and corporate history.

Studies in State Taxation, with particular reference to the Southern States. By members of the Johns Hopkins University. Edited by J. H. Hollander, Ph. D.

Six studies of commonwealth taxation by graduate students of the Johns Hopkins University, are presented in this volume. The States represented—Maryland, Virginia, North Carolina, Georgia, Mississippi and Kansas—fairly reproduce the features of the South.

PROCEEDINGS OF THE SCIENTIFIC ASSOCIATION OF THE JOHNS HOPKINS UNIVERSITY.

One Hundred and Thirty-seventh Regular Meeting, February 17, 1898.

The President of the Association, Professor Remsen, in the Chair.

The following communications were presented and read:

Recent Work on Cathode Rays. By C. W. Waidner.

It was observed more than twenty years ago by Crookes, Goldstein and others, that when an electric discharge is made to pass through a highly exhausted tube, there emanates from the cathode a bundle of rays whose impact on the walls of the glass tube produces there the phenomena of phosphorescence. This bundle of rays has received the name of cathode rays. It was also observed that these rays could exert mechanical action, causing small discs to rotate, etc.; moreover, they were deflected by the approach of an electrified body or a magnet. To account for these phenomena, Crookes advanced the theory that the bundle of cathode rays was made up of material particles, negatively charged, which, on account of the intense electric field in the neighborhood of the cathode, were shot off from the cathode with an enormous velocity. This theory accounted admirably for all the observed phenomena; for, if these rays are made up of a swarm of material particles, their mechanical action is at once accounted for; furthermore, if these particles are negatively electrified, we should expect the approach of a negatively charged body to cause the cathode beam to be repelled, while the approach of a positively charged body should cause the beam to be deflected toward the body, as is actually observed; inasmuch as a moving charge is equivalent to an electric current, the deflection of the cathode rays by a magnet is accounted for.

Recently, however, Lenard has performed an interesting experiment, which is not so readily explained on this theory. He allowed the bundle of cathode rays to fall on a window covered with thin aluminium foil placed at the end of a cylindrical vacuum tube. On exploring the region outside the tube in the neighborhood of the aluminium window, he found rays having the same properties as the cathode rays. These rays, which are found outside the tube, are called Lenard rays. If the cathode rays are made up of solid particles, the question at once arises, "how did they get through the aluminium window into the region outside the tube?" As the explanation of this experiment is not at once evident on the solid particle theory, the theory was advanced that the cathode rays may be due to some process in the ether to which the aluminium is transparent.

Perrin next showed that if the cathode beam passes into a hollow enclosure, through a small opening, it carries into this enclosure a strong negative electrification. If the cathode beam is deflected aside by a magnet or otherwise so that it does not pass through the opening into the body, there is no appreciable trace of electrification. This shows that the cathode rays are always accompanied by negative electrification. This experiment furnishes strong, although not quite conclusive evidence, in support of the solid particle theory.

We see, therefore, that if we accept the ether theory, we can, in a way, see the possibility of the rays getting through the aluminium window in Lenard's experiment, but on the other hand, we must at once admit that it is some process entirely different from any with which we are at present familiar, for no ether waves known to us are acted on in any such way by an electrostatic or a magnetic field. On the other hand, if we accept the solid particle theory we can explain nearly all the observed phenomena with the possible exception of Lenard's experiments. Several plausible suggestions have recently been advanced to explain this experiment on the solid particle theory, but I cannot discuss them in this brief extract.

Prof. J. J. Thomson has recently found, by two entirely independent methods of experiment, for the velocity of the cathode rays a value in the neighborhood of 3×10^9 cms. per second. We see therefore that, if the cathode rays are streams of material particles, we are here dealing with velocities which are enormously greater than any with which we have hitherto been familiar, being comparable to the velocity of light. These experiments have also led to a value for $\frac{m}{e}$, the ratio of the mass of the particle to the charge which it carries, of about 10^{-7}, and further this ratio is independent of the gas through which the charge is passing or the material of which the electrodes are made. The smallest value for $^m/_e$ with which we are familiar is 10^{-4}, for the hydrogen ion in electrolysis. We see, therefore, that the value of $\frac{m}{e}$ for the carriers of the electric charge in the cathode rays is much smaller than in the case of electrolysis. Prof. Thomson gives reasons for believing that the smallness of this quantity is due both to the smallness of m and the largeness of e. These facts have led Prof. Thomson to suggest some startling, but none the less interesting, ideas on the constitution of matter. If the cathode rays are streams of charged particles, we might at least expect to find the value of $\frac{m}{e}$ depend on the nature of the carrier of the charge, as in electrolysis, but the fact that it does not depend on the chemical nature of the gas or the electrode, together with the fact that it has a value so much smaller than for the hydrogen ion, has led Prof. Thomson to suggest that we are here possibly dealing with matter in its simplest state, and that all matter may be built up out of aggregations of this primordial atom. However this may be it certainly explains the observed phenomena, for if the intense electric field near the cathode can dissociate matter into its primordial atoms, the value of $\frac{m}{e}$ would be smaller than for the H ion and it would be the same for all matter.

The great general laws which a system of elements built up by different aggregations of some primordial atom would obey does not admit of rigorous demonstration in the absence of all knowledge of the laws of interaction of these atoms. But, by an interesting analogy with Mayer's floating magnets, Prof. Thomson shows that we might expect such a system to show periodic properties, *i. e.*, to obey some periodic law such as is actually found in Mendeleeff's periodic system of the elements.

2. Recent Additions to our Knowledge of the Ether. By J. S. Ames.

The speaker gave an account of the recent paper by Professor Stokes of Cambridge, in explanation of the X-rays; and further, a brief description of the phenomena recently discovered by Professor Zeeman on the influence of a magnetic field upon radiation.

Professor Stokes's explanation of the X-rays consists in showing that when the cathode rays strike any solid obstacle in the discharge tube, such as a glass wall or a plate of platinum, they must, owing to oscillations of their electric charges, produce electromagnetic disturbances. These disturbances are of the nature of pulses, not waves, since they come at such irregular intervals, and therefore do not give rise to any long continued train of waves. They may be compared to an irregular volley of musketry. Such disturbances of these would advance, as Professor Stokes proves, without suffering refraction or diffraction. They would be transverse disturbances in the ether, and if they were sudden enough and traveled with sufficient velocity they would cause sharp shadows, for reasons which are analogous to those owing to which trains of waves cause sharp shadows. All the phenomena of X-rays can be accounted for perfectly by this explanation of Stokes.

A recent paper by J. J. Thomson treats the same question mathematically, and shows with what velocity and in what manner these pulses would proceed outward from the points of impact of the cathode rays on the solid walls.

The main features of the Zeeman effect, so-called, are that, if the source of radiation, such as a flame or a spark, is placed in a magnetic field and is viewed *along* the lines of force, any single radiation which would produce a single line in the spectrum is so affected as to produce two lines (the so-called magnetic doublet), one component being circularly polarized in a left-handed manner, the other in a right-handed manner; and further,

is same source of radiation is viewed *transversely* to the field of
lines are produced (the so-called magnetic triplet), in which
uter components are plane polarized in one direction, the middle
plane polarized at right-angles to these. It should be noted,
that Cornu has claimed to produce the resolution of the line into
onents instead of three, and there are grave discrepancies between
of various investigators, such as Zeeman himself, Cornu and
. No definite statement can be made at present of the exact
tal results until the methods of experiments are compared and
d.
teresting to note that Zeeman was led to his observation, and
his explanation of it the theory of light due to Professor Lorentz
dam, according to which ether-waves are due to the vibrations of
tions of matter charged electrically.

ndred and Thirty-eighth Regular Meeting, March 17, 1898.

sident of the Association, Professor Remsen, in the Chair.

llowing communications were presented and read:

Grafting of Animals; a New Method of Biological Re-
ch. By R. G. Harrison.

Affinities of the Molluscs. By G. A. Drew.

ndred and Thirty-ninth Regular Meeting, May 5, 1898.

sident of the Association, Professor Remsen, in the Chair.

llowing communications were presented and read:

nt Work on Coral Islands. By H. F. Reid.

a year ago an expedition was fitted out under Professor David,
niversity of Sidney, to make a boring at Funafuti, in order to
whether the coral formations there were very thick or very
thus to discriminate between the rival theories of Darwin and
especting the formation of coral islands.
ring showed a depth of more than 600 feet of coral, and seemed
decide in favor of Darwin's theory.
or Alexander Agassiz has lately returned from a study of the
nds of the Fiji group, which were supposed to illustrate typically
tion of reefs during subsidence. Professor Agassiz finds, how-
fringes at various heights above the sea show that it is a region
ion; and he concludes after further study, that the forms of coral
re not the result of physiographic processes now going on; but
recent coral is probably a small mass built on a foundation pre-
rhaps in Tertiary times, so that their form is not explained by
the rival theories.
tudy of the elevated reefs is needed to show whether they were
uring a time of subsidence or merely by the piling up of talus on
slope of the reef.

Kelvin on the Age of the Earth. By H. F. Reid.

elvin, in his address last year to the Victoria Institute, has given
opinion on the age of the earth. Until the problem was first
him in 1862 to be capable of a definite solution, geological time
dered practically limitless. At that time the data were only well
nown for Lord Kelvin to place the age of the earth between forty
nd four hundred million years. Now the experiments of Barus
plied the constants then lacking and Lord Kelvin confidently
age of the earth between twenty and forty million years, with
lity that it is nearer to the lower than to the higher figure.

Annual Business Meeting, October 20, 1898.

The President of the Association, Professor Remsen, in the Chair.

The meeting was called to order at 2.30 p. m. The following were elected officers for the ensuing year:

Professor Ira Remsen, *President.*
Professor W. H. Howell, *Vice-President.*
Dr. Charles L. Poor, *Secretary.*

The President appointed the following members to act with the officers as a Standing Committee on papers:—Professors Renouf, Ames, Clark, and Dr. Barker.

The One Hundred and Fortieth Regular Meeting, November 10, 1898.

The President of the Association, Professor Remsen, in the Chair.

The following communications were presented and read:

The Newly Discovered Elements in the Atmosphere. By J. E. Gilpin.

An abstract of this paper may be found in the American Chemical Journal.

2. Fermentation Without Cells. By E. Renouf.

An abstract of this paper may be found in the American Chemical Journal.

The One Hundred and Forty-first Regular Meeting, December 15, 1898.

The President of the Association, Professor Remsen, in the Chair.

The following communication was presented and read:

"The Bubonic Plague." By William H. Welch.

The One Hundred and Forty-second Regular Meeting, January 26, 1899.

The President of the Association, Professor Remsen, in the Chair.

The following communication was presented and read:

The Present Status of Electric Power Transmission. By C. T. Hutchinson.

One Hundred and Forty-third Regular Meeting, February 16, 1899.

The President of the Association, Professor Remsen, in the Chair.

The following communication was presented and read:

Science and Agriculture. By Geo. T. Powell.

One Hundred and Forty-fourth Regular Meeting, March 16, 1899.

The President of the Association, Professor Remsen, in the Chair.

The following communication was presented and read:

Recent Ideas on the Physiology of Sleep. By William H. Howell.

RECENT APPOINTMENTS.

The following list contains the names of graduates or former students of this University who have received appointments as professors or instructors within the past year. When no institution is named, the Johns Hopkins University is to be understood.

Mathematics and Astronomy.

J. G. Hardy (Fellow, 1897-98, Ph. D., 1898)—Instructor in Mathematics, Williams College.

E. O. Lovett (Fellow by Courtesy, 1896-97)—Assistant Professor of Mathematics, Princeton University. [Promotion.]

S. A. Mitchell (Fellow, 1897-98, Ph. D., 1898)—Research Fellow, Yerkes Observatory, University of Chicago.

Physics and Electricity.

Byron Briggs Brackett (Ph. D., 1897)—Instructor in Physics, Washington High School.

W. H. Browne, Jr. (A. B., 1891, Proficient in Electricity, 1892)—Assistant Professor of Electrical Engineering, University of Illinois.

C. K. Edmunds (A. B., 1897)—Acting Professor of Physics, University of Utah.

C. T. Hutchinson (Fellow, 1888-89, Ph. D., 1889)—Acting Associate Professor of Electricity.

L. E. Jewell (Special Student, 1886-89, 1890-93)—Assistant in Practical Photography and Spectroscopy.

J. L. Lake (Graduate Student, 1890-93)—Professor of Physics and Astronomy, Ursinus College, Pa.

Henry Lanahan (A. B., 1896)—Professor of Physics, Maryland Agricultural College.

G. C. McKee (Graduate Student, 1892-94)—Instructor in Physics, Westminster College, Pa.

C. E. Mendenhall (Fellow, 1897-98, Ph. D., 1898)—Instructor in Physics, Williams College.

R. B. Owens (Special Student, 1887-88, 1889-90)—Assistant Professor of Electrical Engineering, McGill University, Montreal.

C. E. Phelps, Jr., (Proficient in Electricity, 1894)—Chief Engineer, Electrical Subway Commission, Baltimore.

Edward Rhoads (Ph. D., 1898)—Instructor in Physics, Worcester Polytechnic Institute.

H. A. Sayre (Ph. D., 1896)—Professor of Physics and Astronomy, University of Alabama.

C. W. Waidner (A. B., 1896, Fellow, 1897-98, Ph. D., 1898)—Assistant in Physics.

J. B. Whitehead (Proficient in Electricity, 1893, A. B., 1898)—Instructor in Electricity.

Chemistry.

H. B. Arbuckle (Ph. D., 1898)—Instructor in Sciences, Agnes Scott Institute, Decatur, Ga.

C. G. Cook (Ph. D., 1898)—Chemist, Baltimore.

W. A. Jones (Fellow, 1897-98, Ph. D., 1898)—Analytical Chemist, New York.

L. W. Mattern (Graduate Student, 1896-98)—Chemist, Pennsylvania Railroad Co , Altoona.

E. E. Reid (Fellow, 1897-98, Ph. D., 1898)—Professor of Chemistry and Physics, College of Charleston, S. C.

Garnett Ryland (Ph. D., 1898)—Instructor in Chemistry, University of Maine.

M. B. Stubbs (Ph. D., 1892)—Assistant in Chemistry, Haverford College.

Geology.

Cleveland Abbe, Jr. (Fellow, 1897-98, Ph. D., 1898)—Professor of Geology, Western Maryland College.

R. M. Bagg (Ph. D., 1895, Assistant 1895-97)—Professor of Geology, Colorado College.

C. C. O'Harra (Ph. D., 1898)—Professor of Geology and Mineralogy, South Dakota School of Mines.

Biology.

C. Beatty (A. B., 1896)—Science Instructor, High School, Clarinda, Iowa.

G. A. Drew (Fellow, 1897-98, Ph. D., 1898, Bruce Fellow, 1898)—Assistant in Zoology.

C. W. Greene (Fellow, 1897-98, Ph. D., 1898)—Assistant Professor of Physiology, Leland Stanford, Jr. University.

D. S. Johnson, (Fellow, 1896-97, Ph. D., 1897, Bruce Fellow, 1 —Assistant in Botany.

G. Lefevre (A. B., 1891, Fellow, 1894-95, Bruce Fellow, 1895-97 1896)—Science Master, Boys' High School, Atlanta, Ga.

Medicine.

Reid Hunt (A. B., 1891, Fellow, 1895-96, Ph. D., 1896)—Asso Pharmacology

W. G. MacCallum (M. D., 1897)—Assistant in Pathology.

Classics.

M. Carroll (Fellow, 1892-93, Ph. D., 1893)—Reader in C Archaeology.

W. F. Gill (Graduate Student, 1894-98)—Associate Professor of and Latin, Trinity College, N. C.

Charles Hoeing (Fellow, 1896-98, Ph. D., 1898)—Instructor in University of Rochester.

H. W. Magoun (Fellow, 1887-88, Ph. D., 1890)—Professor of Redfield College, S. D.

D. A. Penick (Fellow, 1897-98, Ph. D., 1898)—Classical Ins Hackettstown, N. J.

C. W. Peppler (A. B., 1892, Fellow, 1895-96, Ph. D., 1898)—Pr of Greek, Emory College, Ga.

Modern Languages.

A. H. Baxter (A. B. 1894, Ph. D., 1898)—Modern Language Country School for Boys, Baltimore.

G. G. Brownell (Graduate Student, 1894-98)—Associate Prof Romance Languages, University of Alabama.

M. P. Brush (Ph. D., 1898)—Instructor in Romance Language State University.

Richard Burton (Ph. D., 1888, Lecturer, 1897-98)—Professor of E University of Minnesota.

Killis Campbell (Fellow, 1897-98, Ph. D., 1898)—Profe English, Culver Military Academy, Ind.

R. H. Griffith (Graduate Student, 1894-96)—Professor of Furman University.

L. M. Harris (Ph. D., 1898)—Professor of English, College of Cha

A. F. Kuersteiner (Graduate Student, 1894-95, 1897-98)—Prof Romance Languages, Indiana University.

H. P. Thieme (A. B., 1893, Ph. D., 1897)—Instructor in Frenc versity of Michigan.

R. H. Wilson (A. B., 1892, Ph. D., 1898)—Instructor in R Languages.

History, Politics, and Economics.

E. J. Benton (Graduate Student, 1897-98)—Teacher of History School, Lafayette, Ind.

J. R. Brackett (Ph. D., 1889)—Lecturer on Public Aid, Chariti Correction.

C. H. Brough (Fellow, 1897-98, Ph. D., 1898)—Professor of Eco and History, Mississippi College.

J. M. Callahan (Fellow, 1896-97, Ph. D., 1897)—Lecturer in Dipl History.

J. A. C. Chandler (Ph. D., 1896)—Professor of History and E Richmond College.

N. A. Flood (A. B., 1890)—Director of the University Press, Uni of Chicago.

S. E. Forman (Ph. D., 1897)—Conductor of Teachers' Institutes, land.

P. L. Kaye (Ph. D., 1898)—Instructor in History, Iowa State Univ

J. H. Latané (A. B., 1892, Ph. D., 1895)—Professor of Histo Economics, Randolph-Macon Woman's College, Lynchburg, Va.; L in American Diplomatic History, Johns Hopkins University.

G. C. Lee (Fellow, 1897-98, Ph. D., 1898)—Instructor in Elocuti History.

J. W. Perrin (Graduate Student, 1890-92) Professor of History, bert College, Cleveland, Ohio.

F. R. Rutter (Fellow, 1896-97, Ph. D., 1897)—U. S. Geol Survey, Washington, D. C.

E. A. Smith (Graduate Student, 1895-98)—Professor of History gheny College, Meadville, Pa.

W. H. Tolman (Ph. D., 1891)—Organizing Secretary, League for Service, New York.

ENUMERATION OF CLASSES, SECOND HALF-YEAR, 1898-99.

Mathematics and Astronomy. (68 Students).

Classes meet in the Physical Laboratory, except as otherwise stated.

Conferences on Selected Topics in Mathematics and Physics. Professor NEWCOMB. Monday, 5 p. m.

Advanced Theory of Functions: Professor CRAIG. Monday, Tuesday, Thursday, 9 a. m., Room 26. (5).

Eisenhart, L. P.
James, G. O.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

General Theory of Differential Equations: Professor CRAIG. Two hours weekly, Room 26. (5).

Eisenhart, L. P.
James, G. O.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Theory of Surfaces: Professor CRAIG. Monday, Tuesday, Thursday, 10 a. m., Room 26. (5).

Eisenhart, L. P.
James, G. O.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Mathematical Conference: Professor CRAIG. Friday, 10 a. m. to 12 m., Room 26. (5).

Eisenhart, L. P.
James, G. O.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Elliptic Functions: Dr. COHEN. Monday, 12 m., Tuesday, 11 a. m., Wednesday, 12 m., Room 26. (7).

Crum, C. W. R.
Eisenhart, L. P.
James, G. O.
Lucke, H. J.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Theoretical Mechanics: Dr. COHEN. Wednesday and Friday, 9 a. m., Room 26. (7).

Crum, C. W. R.
Eisenhart, L. P.
James, G. O.
Lucke, H. J.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Elementary Theory of Functions: Dr. COHEN. Monday, 11 a. m, Wednesday, 10 a. m., Room 26. (12).

Coble, A. B.
Crum, C. W. R.
Eisenhart, L. P.
Gilbert, N. E.
James, G. O.
Lucke, H. J.
McInnes, C. R.
Parsons, L. A.
Pender, H.
Potts, L. M.
Rabinovitch, I. E.
Wallis, W. F.

Differential Equations: Dr. COHEN. Tuesday and Friday, 8 a. m., Room 27. (6).

Coble, A. B.
Kent, N. A.
Kinsley, C.
Loving, R. E.
Meyer, J. F.
Parsons, L. A.

Mathematical Seminary: Dr. COHEN. Friday, 2–4 p. m., Room 26. (7).

Crum, C. W. R.
Eisenhart, L. P.
James, G. O.
Lucke, H. J.
McInnes, C. R.
Rabinovitch, I. E.
Wallis, W. F.

Theory of Equations; Projective Geometry; Analytic Geometry of Three Dimensions: (*Major Course*): Professor HULBURT. Daily, except Monday, 9 a. m., Room 27. (15).

Baetjer, H.
Brooks, C. E.
Cator, G.
Coble, A. B.
Estill, H. S.
Foster, F.
Francis, I. H.
Hyde, E. P.
Kerr, R. C.
Loving, R. E.
Moore, J. H.
Morrison, C. J.
Smith, W. L.
Tondorf, F. A.
Wirt, C. B.

Calculus: (*Minor Course*): Professor HULBURT. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., Thursday, 12 m., Room 27. (20).

Bandel, J. M.
Bruton, A. W.
Cator, G.
Cronin, F. H.
Hatch, E. C.
Hill, H. D.
Illmer, L., Jr.
Moore, J. H.
Morrison, C. J.
Morse, R. B.
Preston, J. O.
Russell, G. W.
Smith, R. T.
Stein, J. S.
Straus, H. P.
Uhrbrock, R. H.
Warner, H. M.
Wolf, M. W.
Wright, H. C.
Zies, F.

Trigonometry; Elementary Analytic Geometry: Dr. COHEN. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., Thursday, 12 m., Room 7, McCoy Hall. (16).

Bird, A. R.
Bye, M.
Dapprich, F. R.
Fenwick, B. L.
Hazen, H. H.
Hill, W. B.
James, W. McC.
Jenness, P.
Kohn, W. I.
Lilly, W. L.
Lisberger, S. J.
Lowndes, E.
Mower, McH.
Raffel, H. B.
Stephens, J. L.
Strouse, E.

Theoretical Astronomy: Associate Professor POOR. Thursday, 12 m., Room 34. (2).

Gilbert, N. E.
Wallis, W. F.

Spherical and Practical Astronomy: Associate Professor POOR. Monday and Wednesday, 2 p. m., Room 34. (7).

Coble, A. B.
Crum, C. W. R.
Lindley, W. P.
Loving, R. E.
Lucke, H. J.
Moore, J. H.
Palmer, E. L.

General Astronomy: (*Undergraduate Elective*): Associate Professor POOR. Monday, 9 a. m., Tuesday, 10 a. m., Room 34. (3).

Routh, J. E.
Taveau, R.
Werber, O. S.

Observatory Work: Associate Professor POOR and Dr. DORSEY Daily. (10).

Coble, A. B.
Crum, C. W. R.
Eisenhart, L. P.
Lindley, W. P.
Loving, R. E.
Lucke, H. J.
McInnes, C. R.
McJunkin, P.
Moore, J. H.
Palmer, E. L.

Physics. (76 Students).

Classes meet in the Physical Laboratory.

Electricity and Magnetism: Professor ROWLAND. Daily, except Wednesday, 10 a. m., Room 24. (13).

Gilbert, N. E.
Huff, W. B.
Kent, N. A.
Kinsley, C.
McJunkin, P.
Merrill, J. F.
Meyer, J. F.
Novak, V.
Potts, L. M.
Reese, H. M.
Saunders, F. A.
Schenck, C. C.
Southall, J. P. C.

Application of Dynamics to Chemistry: Professor AMES. Thursday and Friday, 11 a. m., Room 24. (17).

Gilbert, N. E.
Huff, W. B.
Kent, N. A.
Kinsley, C.
Lucke, H. J.
McJunkin, P.
Merrill, J. F.
Meyer, J. F.
Parsons, L. A.
Pender, H.
Potts, L. M.
Reese, H. M.
Saunders, F. A.
Schenck, C. C.
Southall, J. P. C.
Tondorf, F. A.
Turner, H. J.

Physical Seminary: Professor AMES. Saturday, 9 a. m., Room 23. (19).

Bliss, W. J. A.
Dorsey, N. E.
Gilbert, N. E.
Huff, W. B.
Kent, N. A.
Kinsley, C.
Lucke, H. J.
McJunkin, P.
Merrill, J. F.
Meyer, J. F.
Parsons, L. A.
Pender, H.
Potts, L. M.
Reese, H. M.
Saunders, F. A.
Schenck, C. C.
Southall, J. P. C.
Tondorf, F. A.
Waidner, C. W.

Journal Meeting: Professor ROWLAND and Professor AMES. Wednesday, 11 a. m., Room 23. (22).

Bliss, W. J. A.
Dorsey, N. E.
Fassig, O. L.
Gilbert, N. E.
Huff, W. B.
Jones, H. C.
Kent, N. A.
Kinsley, C.
Lucke, H. J.
McJunkin, P.
Merrill, J. F.
Meyer, J. F.
Novak, V.
Parsons, L. A.
Pender, H.
Potts, L. M.
Reese, H. M.
Saunders, F. A.
Schenck, C. C.
Southall, J. P. C.
Tondorf, F. A.
Waidner, C. W.

General Physics: (*Major Course*): Professor AMES and Dr. BLISS. Daily, except Thursday, 12 m., Room 18. (16).

Case, W. A.
Cator, G.
Coble, A. B.
Estill, H. S.
Francis, I. H.
Gilbert, N. E.
Illmer, L.
Kent, N. A.
Liddell, D. M.
Loving, R. E.
McJunkin, P.
Morrison, C. J.
Parsons, L. A.
Routh, J. E.
Southall, J. P. C.
Tondorf, F. A.

General Physics: (*Minor Course*): Professor AMES. Daily, except Tuesday, 10 a. m., Room 18. (38).

Baetjer, H.
Baldauf, L. K.
Bonsteel, J. A.
Booker, J. M.
Braun, J.
Brooks, C. E.
Chatard, J. A.
Constantine, C. W.
Foster, F.
Frazer, J. C. W.
Garner, W. W.
Griffith, W. A.
Hill, H. D.
Hyde, E. P.
Jenness, P.
Jungbluth, M.
Kerr, R. C.
Leopold, E. J.
Machen, J. G.
Miller, H. C.
Moore, J. H.
Perkins, H. F.
Powell, M. W.
Preston, J. O.
Rehberger, G. E.
Riggins, J. A.
Shreve, O. F.
Smith, W. L.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Taveau, R.
Vogeler, C. A.
West, A. P.
Wilkinson, A. L.
Wirt, C. B.
Wright, H. C.
Zies, F.

Applied Electricity: (*Second Year*): Associate Professor HUTCHINSON. Monday and Tuesday, 9 a. m., Room 24. (10).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Huff, W. B.
Kent, N. A.
Kinsley, C.
Pender, H.
Schoepf, T. H.
Swaine, J. W.

Applied Electricity: (*First Year*): Associate Professor HUTCHINSON. Tuesday, 11 a. m., Wednesday, 9 a. m., Room 24. (5).

Fitzgerald, T.
Huff, W. B.
Nightingale, C. E.
Pender, H.
Schoepf, T. H.

Electrical Seminary: Associate Professor HUTCHINSON, Mr. HERING, Mr. GEER, Mr. WHITEHEAD. Monday, 11 a. m., Room 23. (11).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Fitzgerald, T.
Illmer, L.
Jenness, P.
Kinsley, C.
Nightingale, C. E.
Schoepf, T. H.
Swaine, J. W.

Electrical Measurements: Mr. HERING. Thursday and Friday, 11 a. m., Room 27. (5).

Fitzgerald, T.
Illmer, L.
Jenness, P.
Nightingale, C. E.
Schoepf, T. H.

Central Station Equipment: Mr. HERING. Thursday and Friday, 9 a. m., Room 24. (8).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Jenness, P.
Nightingale, C. E.
Schoepf, T. H.
Swaine, J. W.

Steam and Hydraulic Engineering: Mr. GEER. Wednesday, Thursday, Friday, 10 a. m., Room 27. (6).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Schoepf, T. H.
Swaine, J. W.

Mechanics of Engineering: Mr. GEER. Monday and Tuesday, 10 a. m., Rooms 18 and 27. (4).

Estill, H. S.
Fitzgerald, T.
Nightingale, C. E.
Schoepf, T. H.

Alternating Current Machinery: Mr. WHITEHEAD. Monday and Tuesday, 12 m., Room 24. (6).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Schoepf, T. H.
Swaine, J. W.

Laboratory Work: Professor Rowland, Professor Ames, Associate Professor Hutchinson, Mr. Hering, Mr. Geer, Dr. Bliss, Dr. Dorsey, Mr. Whitehead. Daily, 9 a. m–5 p. m. (75).

Armstrong, J. R. C.
Baetjer, H.
Baldauf, L. K.
Beale, R. B.
Beck, G. C.
Beeuwkes, R. K.
Bonsteel, J. A.
Booker, J. M.
Braun, J.
Brooks, C. E.
Case, W. A.
Cator, G.
Chatard, J. A.
Coble, A. B.
Constantine, C. W.
Estill, H. S.
Everett, W. T.
Fitzgerald, T.
Foster, F.
Francis, I. H.
Frazer, J. C. W.
Garner, W. W.
Gilbert, N. E.
Griffith, W. A.
Hill, H. D.
Huff, W. B.
Hyde, E. P.
Illmer, L.
Jenness, P.
Jungbluth, M.
Kent, N. A.
Kerr, R. C.
Kinsley, C.
Leopold, E. J.
Liddell, D. M.
Loving, R. E.
Lucke, H. J.
Machen, J. G.
McJunkin, P.
Merrill, J. F.
Meyer, J. F.
Miller, H. C.
Moore, J. H.
Morrison, C. J.
Nightingale, C. E.
Novak, V.
Parsons, L. A.
Pender, H.
Perkins, H. F.
Potts, L. M.
Powell, M. W.
Preston, J. O.
Reese, H. M.
Rehberger, G. E.
Riggins, J. A.
Routh, J. E.
Saunders, F. A.
Schenck, C. C.
Schoepf, T. H.
Shreve, O. F.
Smith, W. L.
Southall, J. P. C.
Straus, H. P.
Struth, O. A.
Swaine, J. W.
Swindell, W. B.
Taveau, R.
Tondorf, F. A.
Turner, H. J.
Vogeler, C. A.
West, A. P.
Wilkinson, A. L.
Wirt, C. B.
Wright, H. C.
Zies, F.

Chemistry. (107 Students).

Classes meet in the Chemical Laboratory, except as otherwise stated.

Historical Chemistry: (*For Graduate Students*)*:* Professor Remsen. Daily, except Monday, 9 a. m. (35).

Allen, W. M.
Berkeley, W. N.
Black, H. V.
Blanchard, W. M.
Byers, H. G.
Canter, H.
Case, W. A.
Caspari, C. E.
Chamberlain, J. S.
Chambers, V. J.
Clark, F. E.
Douglas, J. M.
Fischer, J. S.
Fraps, G. S.
Frazer, J. C. W.
Garner, W. W.
Hancock, F. A.
Holmes, W. B.
Horn, D. W.
Humphreys, R. E.
King, S. H.
Knight, N.
Lindley, W. P.
McJunkin, P.
Nakaseko, R.
Olsen, J. C.
Parsons, L. A.
Patterson, A. M.
Russell, G. W.
Simmons, W. W.
Smith, J. B.
Turner, H. J.
Waters, C. E.
Wilson, F. D.
Winston, J. H. C.

Journal Meeting: Professor Remsen. Monday, 9 a. m. (33). The instructors in Chemistry and the following students:

Allen, W. M.
Berkeley, W. N.
Black, H. V.
Blanchard, W. M.
Byers, H. G.
Canter, H.
Case, W. A.
Caspari, C. E.
Chamberlain, J. S.
Chambers, V. J.
Clark, F. E.
Douglas, J. M.
Fischer, J. S.
Fraps, G. S.
Frazer, J. C. W.
Garner, W. W.
Hancock, F. A.
Holmes, W. B.
Horn, D. W.
Humphreys, R. E.
King, S. H.
Knight, N.
Lindley, W. P.
Nakaseko, R.
Olsen, J. C.
Patterson, A. M.
Russell, G. W.
Simmons, W. W.
Smith, J. B.
Turner, H. J.
Waters, C. E.
Wilson, F. D.
Winston, J. H. C.

Physical Chemistry: Dr. H. C. Jones. Thursday and Friday, 12 m. (17).

Allen, W. M.
Armstrong, J. R. C.
Beale, R. B.
Crawford, A. C.
Douglas, J. M.
Fitzgerald, T.
Fraps, G. S.
King, S. H.
Lindley, W. P.
Meyer, J. F.
Nightingale, C. E.
Parsons, L. A.
Potts, L. M.
Schoepf, T. H.
Smith, J. B.
Turner, H. J.
Young, J. F.

Inorganic Chemistry: (*Major Course*)*:* Professor Morse. Daily, except Monday, 9 a. m. (10).

Baldauf, L. K.
Beck, G. C.
Brown, G. V.
Chatard, J. A.
Glaser, O. C.
Meyer, J. F.
Powell, M. W.
Rous, F. P.
Wilkinson, A. L.
Winslow, N.

General Chemistry: (*Minor Course*)*:* Professor Renouf and Dr. Gilpin. Daily, except Monday, 9 a. m., Hopkins Hall. (50).

Abercrombie, R. T.
Bandel, J. M.
Braun, J.
Bruton, A. W.
Bye, M.
Constantine, C. W.
Cook, T.
Cronin, F. H.
Dapprich, F. R.
Davidson, G. D.
Duck, R. S.
Eager, J. H.
Ewell, J. E.
Fooks, W. M.
Gemmill, J. R.
Greene, J. D.
Griffin, E. J.
Griffin, J. W.
Griffith, W. A.
Hatch, E. C.
Heyman, S.
Hill, H. D.
Hill, J. P.
James, W. McC.
Joyner, L. L.
Knapp, G. W.
Krager, W. M.
Kurrelmeyer, H.
Leopold, E. J.
Mackall, L. L.
Morse, R. B.
Mower, F. D.
Preston, J. O.
Rehberger, G. E.
Rehberger, J. M.
Riggins, J. A.
Roulston, R. B.
Shreve, O. F.
Shippen, L. P.
Smith, R. T.
Stein, J. S.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Vogeler, C. A.
Warner, H. M.
West, A. P.
Wingert, M.
Wolf, M. W.
Zies, F.

Laboratory Work: Professor Remsen, Professor Morse, Professor Renouf, Dr. Gilpin, Dr. H. C. Jones, Dr. Reese. Daily, 9 a. m. to 5 p. m. (100).

Abercrombie, R. T.
Allen, W. M.
Baldauf, L. K.
Bandel, J. M.
Bates, J. S.
Beck, G. C.
Berkeley, W. N.
Black, H. V.
Blanchard, W. M.
Braun, J.
Brown, G. V.
Bruton, A. W.
Bye, M.
Byers, H. G.
Canter, H.
Case, W. A.
Caspari, C. E.
Chamberlain, J. S.
Chambers, V. J.
Chatard, J. A.
Clark, F. E.
Constantine, C. W.
Cook, T.
Cronin, F. H.
Dapprich, F. R.
Davidson, G. D.
Douglas, J. M.
Duck, R. S.
Eager, J. H.
Ewell, J. E.
Ferguson, J. F.
Fischer, J. S.
Flinn, F. B.
Fooks, W. M.
Fraps, G. S.
Frazer, J. C. W.
Garner, W. W.
Gemmill, J. R.
Glaser, O. C.
Greene, J. D.
Griffin, E. J.
Griffin, J. W.
Griffith, W. A.
Hancock, F. A.
Hatch, E. C.
Heyman, S.
Hill, H. D.
Hill, J. P.
Holmes, W. B.
Horn, D. W.
Humphreys, R. E.
James, W. McC.
Joyner, L. L.
King, S. H.
Knapp, G. W.
Knight, N.
Krager, W. M.
Kurrelmeyer, H.
Leopold, E. J.
Lindley, W. P.
Mackall, L. L.
Meyer, J. F.
Morse, R. B.
Mower, F. D.
Nakaseko, R.
Olsen, J. C.
Parsons, L. A.
Patterson, A. M.
Powell, M. W.
Preston, J. O.
Rehberger, G. E.
Rehberger, J. M.
Riggins, J. A.
Roulston, R. B.
Rous, F. P.
Russell, G. W.
Seth, A. L.
Shippen, L. P.
Shreve, O. F.
Simmons, W. W.
Smith, J. B.
Smith, R. T.
Stein, J. S.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Turner, H. J.
Vogeler, C. A.
Warner, H. M.
Waters, C. E.
West, A. P.
Wilkinson, A. L.
Wilson, F. D.
Wingert, M.
Winslow, N.
Winston, J. H. C.
Wolf, M. W.
Wright, A.
Young, J. F.
Zies, F.

Geology. (34 Students).

Classes meet in the Geological Laboratory.

General Geology: Professor Clark and Dr. Shattuck. Lectu daily, except Friday, 1 p. m.; Laboratory work, Wednesday, 2–5 p. Excursions, Saturdays during the Autumn. (32).

Baetjer, H.
Bibbins, A.
Black, H. V.
Blanchard, W. M.
Bonsteel, J. A.
Brown, G. V.
Clark, F. E.
Cleaver, W. M.
Cragin, F. W.
Fassig, O. L.
Flinn, F. B.
Garner, W. W.
Glenn, L. C.
Hancock, F. A.
Hindshaw, H. H.
Holmes, W. B.
Horn, D. W.
Humphreys, R. E.
Hyde, E. P.
Levering, J.
Martin, G. C.
McAll, R. L.
McLaughlin, A. C.
Patterson, A. M.
Remsen, C. M
Rous, F. P.
Routh, J. E.
Rowe, R. B.
Werber, O. S.
Wright, A.
Wright, F. B.
Wright, H. C.

Paleontology: Professor Clark. Monday and Thursday, 4 p. (10).

Bonsteel, J. A.
Cleaver, W. M.
Cragin, F. W.
Curtis, W. C.
Hindshaw, H. H.
Martin, G. C.
McLaughlin, A. C.
Reese, A. M.
Rowe, R. B.
Wright, F. B.

Paleontology: (*Laboratory Work*)*:* Professor Clark and Dr. Sн tuck. Wednesday and Thursday, 2–5 p. m. (11).

Bibbins, A.
Bonsteel, J. A.
Cleaver, W. M.
Cragin, F. W.
Curtis, W. C.
Glenn, L. C.
Hindshaw, H. H.
Martin, G. C.
McLaughlin, A. C.
Rowe, R. B.
Wright, F. B

Geological Physics: Associate Professor Reid. Tuesday and Th day, 12 m. (6).

Bonsteel, J. A.
Cleaver, W. M.
Martin, G. C.
McLaughlin, A. C.
Rowe, R. B.
Wright, F. B.

Exploratory Surveying: Associate Professors Poor and R. Thursday and Friday, 11 a. m. (7).

Bonsteel, J. A.
Cleaver, W. M.
Martin, G. C.
McLaughlin, A. C.
Morrison, C. J.
Rowe, R. B.
Wright, F. B

Petrography: Dr. Mathews.

Lectures: Monday, Tuesday, Wednesday, 11 a. m. (8).

Bonsteel, J. A.
Cleaver, W. M.
Cragin, F. W.
Glenn, L. C.
Hindshaw, H. H.
Martin, G. C.
Rowe, R. B.
Wright, F.

Laboratory Work: Monday and Tuesday, 2–5 p. m., Wednesday, T day, Friday, 9 a. m. to 5 p. m. (9).

Cleaver, W. M.
Cragin, F. W.
Fassig, O. L.
Glenn, L. C.
Hindshaw, H. H.
Martin, G. C.
McLaughlin, A. C.
Rowe, R. B
Wright, F.

Structural Geology: Mr. Willis. Tuesday and Wednesday, 4 (9).

Bonsteel, J. A.
Cleaver, W. M.
Cragin, F. W.
Glenn, L. C.
Hindshaw, H. H.
Martin, G. C.
McLaughlin, A. C.
Rowe, R. B
Wright, F.

Meteorology: Professor Abbe. Wednesday, 12 m. (8).

Bonsteel, J. A.
Clark, F. E.
Cleaver, W. M.
Cragin, F. W.
Martin, G. C.
McLaughlin, A. C.
Rowe, R.
Wright, F

Journal Meeting: Professor Clark, Associate Professor Dr. Mathews. Friday, 9 a. m. (12).

Bibbins, A.
Bonsteel, J. A.
Cleaver, W. M.
Cragin, F. W.
Fassig, O. L.
Glenn, L. C.
Hindshaw, H. H.
Martin, G. C.
McLaughlin, A. C.
Rowe, R.
Shattuck, G
Wright, F.

Biology. (112 Students).

Classes meet in the Biological Laboratory, except as otherwise *stated.*

Advanced Zoology: Professor Brooks. Daily, 9 a. m. to 5 p. (12).

Berger, E. W.
Coker, W. C.
Cragin, F. W.
Curtis, W. C.
Drew, G. A.
Grave, C.
Griffin, L. E.
Knower, H. M.
Perkins, H. F.
Reese, A. M.
Stein, L. D.
Sudler, M. T.

Zoological Journal Club: Professor Brooks, Associate Professo Andrews, Dr. Barton. Monday, 11 a. m. (13).

Berger, E. W.
Coker, W. C.
Curtis, W. C.
Drew, G. A.
Grave, C.
Griffin, L. E.
Johnson, D. S.
Knower, H. M.
Metcalf, M. M.
Perkins, H. F.
Reese, A. M.
Stein, L. D.
Sudler, M. T.

Zoology: (*Undergraduate Elective*)*:* Associate Professor Andrew Tuesday, 2–4 p. m. (3).

Jungbluth, K.
Levering, J.
Taveau, R.

Zoology: (*Major Course*)*:* Associate Professor Andrews. Daily, exce Monday, 9 a. m.; Monday and Tuesday, 2–5 p. m.; until March 15. (5

Anderson, R. B. T.
Jungbluth, M.
Lazenby, M.
McAll, R. L.
Thomas, R. H.

Physiological Seminary: Professor Howell. Monday, 10 a. in the Physiological Laboratory. (6).

Curtis, W. C.
Dawson, P. M.
Griffin, L. E.
Herrick, J. C.
Stein, L. D.
Walden, E. C.

Physiological Journal Club: Professor Howell. Mond 9 a. m., in the Physiological Laboratory. (5).

Dawson, P. M.
Dreyer, G. P.
Herrick, J. C.
Hunt, R.
Walden, E. C.

Animal Physiology: Professor HOWELL. Thursday and Friday, 12 m.; daily, after March 15, in the Physiological Laboratory. (68).

Graduate Students.

Curtis, W. C.
Griffin, L. E.
Herrick, J. C.
Rich, H. L.
Stein, L. D.
Walden, E. C.

Medical Students (1*st Year*).

Auer, J.
Briggs, J. B., Jr.
Browne, B. B.
Bruns, R. M.
Bryan, W. M. C.
Bush, C.
Chase, L. A.
Churchman, J. W.
Clarke, T. W.
Cook, H. W.
Coons, J. J.
Cooper, J. C.
Dohme, G. C.
Dolley, D. H.
Dudley, H.
Duffy, R.
Dunlop, J.
Eddy, D. L.
Erving, W. G.
Ferry, N. S.
Fogle, C. V.
Foster, N. B.
Francis, W. W.
Frankenthal, M. A.
Geraghty, J. T.
Glenny, W. H.
Grant, J. F.
Haviland, M. L.
Haynes, M. S.
Hirshberg, L. K.
Horst, C. H.
Hyman, S.
Jelke, W. F.
Jones, T. M.
Karsted, A.
Lehr, L. C.
L'Engle, E. M.
Lincoln, M. W.
Litchfield, G. V., Jr.
Lootz, E.
Ludlum, S. D.
MacGregor, G. M.
Marshall, S. A.
McFarland, J. S.
Meisenhelder, E. W.
Meisenhelder, J. E.
Ochsner, H. W.
Pelton, G. I.
Reede, E. H.
Riggins, E. N.
Riggs, T. F.
Rogers, C. P.
Scholl, G. B.
Silverberg, M.
Simpson, J. N.
Tallant, A. W.
Van Arsdall, C. B.
Van Denburgh, J.
Wight, O. B.
Williams, C. L.
Williams, D
Wright, C. B.

General Physiology and Vertebrate Histology: (*Major Course*)*:* Dr. DREYER. Daily, except Monday, 9 a. m.; Monday and Friday, 2–5 p. m.; after March 15. (5).

Anderson, R. B. T.
Jungbluth, M.
Lazenby, M.
McAll, R. L.
Thomas, R. H.

General Biology: (*Minor Course*)*:* Associate Professor ANDREWS. Thursday and Friday, 10 a. m, 2–5 p. m. (29).

Abercrombie, R. T.
Bates, J. S.
Breed, A. A.
Briscoe, J. S.
Chatard, J. A.
Fischer, J. S.
Frank, S. W.
Fraps, G. S.
Glaser, O. C.
Greenbaum, H. S.
Guggenheimer, C. M.
Hanna, H. S.
Haskell, L. W.
Hollander, L. M.
Keidel, A.
Mackall, L. L.
Manken, H.
McAll, R. L.
Noble, E. R.
Perkins, H. F.
Purcell, T. N. D.
Reymann, L. A.
Robinson, G. C.
Rous, F. P.
Spenoer, L. C.
Sudler, M. T.
Tondorf, F. A.
Werber, O. S.
Wilkinson, A. L.

Osteology: (*Minor Course*)*:* Associate Professor ANDREWS. Monday and Wednesday, 10 a. m. (26).

Abercrombie, R. T.
Bates, J. S.
Breed, A. A.
Briscoe, J. S.
Chatard, J. A.
Fischer, J. S.
Frank, S. W.
Glaser, O. C.
Greenbaum, H. S.
Guggenheimer, C. M.
Hanna, H. S.
Haskell, L. W.
Hollander, L. M.
Keidel, A.
Mackall, L. L.
Manken, H.
McAll, R. L.
Noble, E. R.
Reymann, L. A.
Robinson, G. C.
Rous, F. P.
Spencer, L. C.
Sudler, M. T.
Tondorf, F. A.
Werber, O. S.
Wilkinson, A. L.

Botany: (*For Graduates*)*:* Dr. D. S. JOHNSON. Monday and Tuesday, 10 a. m.; Thursday and Friday, 10 a. m., 2–5 p. m. (3).

Chambers, V. J.
Coker, W. C.
Griffin, L. E.

Laboratory Work: Professor BROOKS, Professor HOWELL, Associate Professor ANDREWS, Dr. DREYER, Dr. JOHNSON, Dr. DREW. Daily, 9 a. m. to 5 p. m. (111).

Abercrombie, R. T.
Anderson, R. B. T.
Auer, J.
Bates, J. S.
Berger, E. W.
Breed, A. A.
Briggs, J. B., Jr.,
Briscoe, J. S.
Browne, B. B.
Bruns, R. M.
Bryan, W. M. C.
Bush, C.
Chambers, V. J.
Chase, L. A.
Chatard, J. A.
Churchman, J. W.
Clarke, T. W.
Coker, W. C.
Cook, H. W.
Coons, J. J.
Cooper, J. C.
Cragin, F. W.
Curtis, W. C.
Dawson, P. M.
Dohme, G. C.
Dolley, D. H.
Dudley, H.
Duffy, R.
Dunlop, J.
Eddy, D. L.
Erving, W. G.
Ferry, N. S.
Fischer, J. S.
Fogle, C. V.
Foster, N. B.
Francis, W. W.
Frank, S. W.
Frankenthal, M. A.
Geraghty, J. T.
Glaser, O. C.
Glenny, W. H.
Grant, J. F.
Grave, C.
Greenbaum, H. S.
Griffin, L. E.
Guggenheimer, C. M.
Hanna, H. S.
Haskell, L. W.
Haviland, M. L.
Haynes, M. S.
Herrick, J. C.
Hirshberg, L. K.
Hollander, L. M.
Horst, C. H.
Hyman, S.
Jelke, W. F.
Jones, T. M.
Jungbluth, K.
Jungbluth, M.
Karsted, A.
Keidel, A.
Knower, H. M.
Lazenby, M.
Lehr, L. C.
L'Engle, E. M.
Levering, J.
Lincoln, M. W.
Litchfield, G. V., Jr.
Lootz, E.
Ludlum, S. D.
MacGregor, G. M.
Mackall, L. L.
Manken, H.
Marshall, S. A.
McAll, R. L.
McFarland, J. S.
Meisenhelder, E. W.
Meisenhelder, J. E.
Noble, E. R.
Ochsner, H. W.
Pelton, G. I.
Perkins, H. F.
Purcell, T. N. D.
Reede, E. H.
Reese, A. M.
Reymann, L. A.
Rich, H. L.
Riggins, E. N.
Riggs, T. F.
Robinson, G. C.
Rogers, C. P.
Rous, F. P.
Scholl, G. B
Silverberg, M.
Simpson, J. N.
Spencer, L. C.
Stein, L. D.
Sudler, M. T.
Tallant, A. W.
Taveau, R.
Thomas, R. H.
Tondorf, F. A.
Van Arsdall, C. B.
Van Denburgh, J.
Walden, E. C.
Werber, O. S.
Wight, O. B.
Wilkinson, A. L.
Williams, C. L.
Williams, D.
Wright, C. B.

Greek. (36 Students).

Classes meet in McCoy Hall.

Greek Seminary: *Aristophanes:* Professor GILDERSLEEVE. Monday and Wednesday, 10 a. m., Room 14. (14).

Archibald, H. T.
Beardsley, W. F.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Comicorum Graecorum Fragmenta: Professor GILDERSLEEVE. Tuesday 10 a. m., Room 14. (15).

Archibald, H. T.
Beardsley, W. F.
Blackwell, I. H.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Greek Syntax: Professor GILDERSLEEVE. Thursday, 10 a. m., Room 14. (17).

Archibald, H. T.
Baden, W. W.
Beardsley, W. F.
Blackwell, I. H.
Eckels, W. A.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Readings in Greek Tragic Poets: Professor GILDERSLEEVE. Friday, 10 a. m., Room 14. (15).

Archibald, H. T.
Beardsley, W. F.
Blackwell, I. H.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Greek Rhythms and Metres: Associate Professor MILLER. Tuesday and Thursday, 9 a. m., Room 15. (15).

Archibald, H. T.
Beardsley, W. F.
Eckels, W. A.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Kern, J. W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Classical Archaeology: Dr. CARROLL.

Introduction to Greek Sculpture: Thursday, 3 p. m., Room 15. (11).

Anderson, R. B. T.
Beardsloy, W. F.
Burrell, J. L. A.
Foote, T. C.
Foster, H. B.
Guernsey, R.
Hamilton, H. A.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Smith, C. S.

Antique Aesthetics: Friday, 12 m., Room 19. (5).

Guernsey, R.
Hamilton, H. A.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.

Elegiac, Iambic, and Melic Poets; Sophocles: (*Major Course*)*:* Associate Professor SPIEKER. Monday, Tuesday, Wednesday, 12 m., Room 10. (8).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Purcell, T. N. D.
Shriver, W. P.
Wight, C.

Lysias, *Epitaphius;* ***Euripides:*** (*Minor Course*)*:* Associate Professor SPIEKER. Tuesday, Wednesday, Thursday, 1 p. m., Room 10. (9).

Blackwell, I. H.
Booker, J. M.
Briscoe, J. S.
Fishach, L. G.
Machen, J. G.
Manken, H.
Noble, E. R.
Powers, H. W. S.
Spencer, L. C.

Prose Composition: Associate Professor SPIEKER.

Major Course: Friday, 12 m., Room 10. (8).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Purcell, T. N. D.
Shriver, W. P.
Wight, C.

Minor Course: Monday, 1 p. m., Room 10. (9).

Blackwell, I. H.
Booker, J. M.
Briscoe, J. S.
Fishach, L. G.
Machen, J. G.
Manken, H.
Noble, E. R.
Powers, H. W. S.
Spencer, L. C.

Herodotus, book vii; ***Prose Composition:*** Associate Professor MILLER. Monday, 10 a. m., Thursday and Friday, 1 p. m., Room 8. (3).

Fenwick, B. L.
Mower, McH.
Stephens, J. L.

Latin. (65 Students).

Classes meet in McCoy Hall.

Latin Seminary: *Cicero:* Professor WARREN. Tuesday and Friday, 11 a. m., Room 15. (15).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Griffith, G.
Guernsey, R.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Roman Forum and the Imperial Fora: Professor WARREN. Monday, 11 a. m., Room 15. (18).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Griffith, G.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Incertus Auctor ad Herennium: Professor WARREN. Thursday, 11 a. m., Room 15. (15).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Griffith, G.
Guernsey, R.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Journal Club: Professor WARREN. Tuesday, 12 m., Room 15. (17).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Griffith, G.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Practical Exercises: Associate Professor SMITH. Wednesday, 11 a. m., Room 15. (17).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Griffith, G.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Hullihen, W.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

The Silvae of Statius: Dr. H. L. WILSON. Wednesday, 12 m., Room 15. (17).

Archibald, H. T.
Basore, J. W.
Beardsley, W. F.
Blackwell, I. H.
Canter, H. V.
Foote, T. C.
Foster, H. B.
Griffith, G.
Guernsey, R.
Hamilton, H. A.
Haywood, R. W.
Hulliben, W.
McWhorter, A. W.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Tacitus: (*Elective*): Associate Professor SMITH. Monday, 9 a. m., Tuesday, 10 a. m., Room 10. (4).

Davidson, G. D.
Fisher, F. C.
Ross, W. L.
Spilman, E. A.

Terence and Plautus: (*Major Course*): Associate Professor SMITH. Wednesday, Thursday, and Friday, 10 a. m., Room 10. (8).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Purcell, T. N. D.
Roulston, R. B.
Wight, C.

Roman Literature: (*Minor Course*): Associate Professor SMITH. Tuesday, 9 a. m., Room 11. (16).

Bernheim, B. M.
Bird, A. R.
Boyer, N.
Brady, J. H.
Brown, E. B.
Byrne, H. S.
Harris, W. H.
Hollander, L. M.
Kohn, W. I.
Lowndes, E.
Norton, E. L.
Raffel, H. B.
Sayler, J. A.
Turnbull, B.
Tyler, J. E.
Whitman, H. S.

Livy: (*Minor Course*): Dr. H. L. WILSON. Wednesday, Thursday, and Friday, 9 a. m., Room 12. (25).

Bernheim, B. M.
Bird, A. R.
Booker, J. M.
Boyer, N.
Brady, J. H.
Briscoe, J. S.
Brown, E. B.
Byrne, H. S.
Fishach, L. G.
Harris, W. H.
Hollander, L. M.
Kohn, W. I.
Lowndes, E.
Machen, J. G.
Manken, H.
Miller, H. C.
Noble, E. R.
Norton, E. L.
Powers, H. W. S.
Raffel, H. B.
Sayler, J. A.
Spencer, L. C.
Turnbull, B.
Tyler, J. E.
Whitman, H. S.

Cicero's Letters; Sallust; Prose Composition: Dr. H. L. WILSON. Wednesday, Thursday, and Friday, 10 a. m., Room 8. (10).

Cook, T. G.
Dapprich, F. R.
Fenwick, B. L.
Hazen, H. H.
Hill, W. B.
Lilly, W. L.
Lisberger, S. J.
Mower, McH.
Stephens, J. L.
Strouse, E.

Prose Composition:

Major Course: Associate Professor SMITH. Monday, 10 a. m., Room 10. (8).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Purcell, T. N. D.
Roulston, R. B.
Wight, C.

Minor Course: Dr. H. L. WILSON. Tuesday, 9 a. m, Room 12. (9).

Booker, J. M.
Briscoe, J. S.
Fishach, L. G.
Machen, J. G.
Manken, H.
Miller, H. C.
Noble, E. R.
Powers, H. W. S.
Spencer, L. C.

Sanskrit and Comparative Philology. (27 Students).

Classes meet in McCoy Hall, Room 19.

Comparative Philology: Professor BLOOMFIELD. Monday, 4 p. m. (14).

Beardsley, W. F.
Bogue, H.
Chambers, L. M.
Fisher, F. C.
Fowler, T. H.
French, J. C.
Guernsey, R.
Harwood, S. P.
King, J. H.
McWhorter, A. W.
Ragland, G.
Ross, W. L.
Smith, C. S.
Spilman, E. A.

Comparative Grammar: *Indo-European Vocalism:* Professor BLOOMFIELD. Thursday, 4 p. m. (12).

Beardsley, W. F.
Blake, F. R.
Foote, T. C.
Guernsey, R.
Hamilton, H. A.
Kern, J. W.
Kurrelmeyer, W.
McWhorter, A. W.
Milden, A. W.
Ness, J. A.
Pyle, T. L.
Smith, C. S.

Lithuanian Language and Literature: Professor BLOOMFIELD. Tuesday, 12 m. (3).

Blake, F. R.
Kurrelmeyer, W.
Ness, J. A.

Vedic Seminary: *The Hymns of the Rig-Veda:* Professor BLOOMFIELD. Friday, 4 p. m. (5).

Blake, F. R.
Ewing, A. H.
Foster, H. B.
Kern, J. W.
Ness, J. A.

Interpretation of the Drama Çakuntala: Professor BLOOMFIELD. Wednesday, 4 p. m. (4).

Blake, F. R.
Ewing, A. H.
Foster, H. B.
Ness, J. A.

Readings from the Hitopadeça and the Mānavadharmaçāstra: Mr. BLAKE. Thursday, 3 p. m. (3).

Ewing, A. H.
Kurrelmeyer, W.
Savage, C. A.

Elementary Sanskrit: Professor BLOOMFIELD. Monday and Thursday, 12 m. (12).

Archibald, H. T.
Beardsley, W. F.
Blackwell, I. H.
Ewing, A. H.
Fowler, T. H.
Guernsey, R.
Kurrelmeyer, H.
McWhorter, A. W.
Pyle, T. L.
Ragland, G.
Savage, C. A.
Smith, C. S.

Oriental Seminary. (20 Students).

Classes meet in the Dillmann Library, McCoy Hall, Room 18.

Hebrew: (*Second Year's Course: Interpretation of the Book of Gene* Professor Haupt. Monday, 3 p. m. (8).

Blake, F. R.
Caldwell, W.
Foote, T. C.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Rosenau, W.
Schanfarber,

Exercises in Reading Hebrew at Sight: (*Selected Psal* Dr. JOHNSTON. Tuesday, 10 a. m. (3).

Blake, F. R.
Foote, T. C.
McPherson, W. B.

Hebrew Prose Composition: (*Translating from English into Heb* Professor HAUPT. Tuesday, 3.30 p. m. (7).

Blake, F. R.
Foote, T. C.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Rosenau, W.
Schanfarber,

Comparative Semitic Grammar: Professor HAUPT. Mo 4 p. m. (8).

Blake, F. R.
Foote, T. C.
Caldwell, W.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Rosenau, W.
Schanfarber,

Hebrew: (*Advanced Course: Critical Interpretation of the Book of* Professor HAUPT. Monday, 5 p. m. (8).

Blake, F. R.
Caldwell, W.
Foote, T. C.
Grimm, K. J.
Guttmacher, A.
McPherson, W. B.
Rosenau, W.
Schanfarber,

Elementary Hebrew: (*Gesenius-Kautzsch's Hebrew Grammar,* *lated by Collins and Cowley; Genesis, ed. Baer-Delitzsch*): Mr. GR Wednesday, 3–5 p. m. (2).

Foote, T. C.
Jones, J. W.

Biblical Aramaic: (*Interpretation of the Aramaic Portions of the of Ezra*): Professor HAUPT. Tuesday, 5 p. m. (4).

Blake, F. R.
Foote, T. C.
Grimm, K. J.
McPherson,

Arabic for Beginners: (*Socin's Grammar*): Dr. JOHNSTON. F 3 p. m. (3).

Ewing, A. H.
Gould, W. E.
Mosemiller, C. A.

Arabic: (*Second Year's Course: Brünnow's Chrestomathy*): Dr. J STON. Tuesday, 11 a. m. (2).

McPherson, W. B.
Ewing, A. H.

Arabic: (*Advanced Course*): Dr. JOHNSTON. Wednesday, 11 a. m.

Blake, F. R.
Ewing, A. H.
Grimm, K. J.

Arabic Prose Composition: (*Translating from English into Arab* Professor HAUPT. Tuesday, 3 p. m. (6).

Blake, F. R.
Ewing, A. H.
Grimm, K. J.
Guttmacher, A.
Rosenau, W.
Schanfarber,

Assyrian: (*Second Year's Course: Meissner's Chrestomathy*): Dr. Jo STON. Tuesday, 12 m. (2).

McPherson, W. B.
Foote, T. C.

Epistolary Literature of the Assyrians and Babylonian Dr. JOHNSTON. Wednesday, 10 a. m. (1).

Grimm, K. J.

Assyrian Prose Composition: (*Translating from English* *Hebrew into Assyrian*): Professor HAUPT. Tuesday, 4 p. m. (4).

Blake, F. R.
Foote, T. C.
Grimm, K. J.
McPherson, W.

Ethiopic: Professor HAUPT. Wednesday, 5 p. m. (2).

Blake, F. R.
Grimm, K. J.

Egyptian for Beginners: (*Erman's Grammar*): Dr. JOHNSTO Friday, 10 a. m. (6).

Blake, F. R.
Bright, J. W.
Dennis, J. T.
Foote, T. C.
Grimm, K. J.
McPherson, W.

Egyptian Archæology: Dr. JOHNSTON. Friday, 4 p. m. (9).

Blackiston, A. H.
Ballard, Z. M.
DeGrange, McQ.
Dennis, J. T.
Foote, T. C.
Mackall, L. L.
McPherson, W. B.
Sioussat, St. G.
Sommerville, C.

English. (134 Students).

Classes meet in McCoy Hall.

English Seminary: (*The English Drama before Shakespeare*): P fessor BRIGHT. Tuesday and Thursday, 3–5 p. m., Room 4. (13).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Griffin, N. E.
Griffith, G.
Hagen, S. N.
Huguenin, J.
Miles, L. W.
Parham, D. P.
Schneider, J.
West, H. S.
Wharey, J. B.

Historical English Grammar: (*Lectures*): Professor BRIG Monday, 11 a. m., Tuesday, 12 m., Room 12. (14).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Fowler, T. H.
Griffin, N. E.
Griffith, G.
Hagen, S. N.
Huguenin, J.
Miles, L. W.
Parham, D. P.
Schneider, J.
West, H. S.
Wharey, J. B.

The Poems of Shakespeare; Havelok the Dane: Professor BRIGHT. Wednesday, 4 p. m., Thursday, 12 m., Room 12. (14).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Griffin, N. E.
Griffith, G.
Hagen, S. N.
Hood, F.
Huguenin, J.
Miles, L. W.
Parham, D. P.
Schneider, J. P.
West, H. S.
Wharey, J. B.

Journal Meeting: Professor BRIGHT. Alternate Fridays, 4–6 p. m., Room 4. (14).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Griffin, N. E.
Griffith, G.
Hagen, S. N.
Hood, F.
Huguenin, J.
Miles, L. W.
Parham, D. P.
Schneider, J. P.
West, H. S.
Wharey, J. B.

Anglo-Saxon: (*Major Course*): Professor BRIGHT. Monday and Wednesday, 12 m., Room 8. (3).

Fosnocht, E. B.
Hood, F.
Schneider, J. P.

The Caroline Poets; Foundations of Literary Criticism: (*For Graduates*): Professor BROWNE. Wednesday, 11 a. m., Room 8. (14).

Barr, M. L.
Brown, G. D.
Butler, P.
Farr, J. M.
Fowler, T. H.
Griffin, N. E.
Hagen, S. N.
Hood, F.
Huguenin, J.
Miles, L. W.
Miller, R. D.
Parham, D. P.
West, H. S.
Wharey, J. B.

Literature of the Fourteenth Century; Early Scottish Poets: (*Major Course*): Professor BROWNE. Tuesdays and Fridays, 12 m., Room 8. (2).

Fosnocht, E. B.
Hood, F.

Early English Texts; English Literature: (*Minor Course*): Professor BROWNE. Daily, except Friday, 1 p. m., Room 6. (8).

Ember, A.
Gaddess, C. C.
Gemmill, J. R.
Haskell, L. W.
Robinson, E. A.
Robinson, G. C.
Smull, M. N.
Wight, C.

English Literature: (*Undergraduate Elective*): Professor GREENE. Thursday, 12 m., Friday, 1 p. m., Room 9. (12).

Bogue, H.
Chambers, L. M.
Clarke, G. M.
Ensor, J. T.
Fisher, F. C.
Frank, S. W.
French, J. C.
Grimes, R. H.
Guthrie, C. E.
King, J. H.
Murkland, P. A.
Thomas, R. H.

English Literature: (*Required Undergraduate Course*): Professor GREENE. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday, 11 a. m., Room 11. (42).

Anderson, R. B. T.
Baetjer, H.
Beeuwkes, C. J.
Bernheim, B. M.
Bouchelle, B. N.
Breed, A. A.
Brooks, C. E.
Burrell, J. L. A.
Clark, C. T.
De Grange, M.
Eager, J. H.
Ewell, J. E.
Ford, C. E.
Foster, F.
Francis, I. H.
Glaser, O. C.
Greene, J. D.
Heyman, S.
Hill, J. P.
Homer, H. L.
Hyde, E. P.
Jones, J. W.
Kerr, R. C.
Liddell, D. M.
Lindheim, N. R.
Mackall, L. L.
Marshall, T. H.
McAll, R. L.
Moore, J. S.
Powell, M. W.
Purcell, T. N. D.
Roulston, R. B.
Rous, F. P.
Schermerhorn, A. V. R.
Shriver, W. P.
Smith, W. L.
Spencer, E. M.
Stephens, C. G.
Taneyhill, G. L.
Wingert, M.
Winslow, N.
Wright, A.

Rhetoric and English Composition: Professor GREENE and Mr. THOM. Monday, Tuesday, Wednesday, 12 m. (5).

Section A: Room 9. (26).

Bird, A. R.
Booker, J. M.
Boyer, N.
Briscoe, J. S.
Bye, M.
Ember, A.
Fishach, L. G.
Hollander, L. M.
Jones, J. W.
Leopold, E. J.
Machen, J. G.
Miller, H. C.
Morse, R. B.
Noble, E. R.
Raffel, H. B.
Riggins, J. A.
Shippen, L. P.
Shreve, O. F.
Spencer, L. C.
Straus, H. P.
Strouse, E.
Swindell, W. B.
Turnbull, B.
Vogeler, C. A.
Warner, H. M.
Zies, F.

Section B: Room 11. (33).

Baldauf, L. K.
Bandel, J. M.
Braun, J.
Brown, E. B.
Bruton, A. W.
Byrne, H. S.
Constantine, C. W.
Cook, T. G.
Cronin, F. H.
Dapprich, F. R.
Duck, R. S.
Ford, C. E.
Grasty, J. S.
Griffith, W. A.
Hatch, E. C.
James, W. McC.
Lilly, W. L.
Lisberger, S. J.
Lowndes, E.
Manken, H.
Mower, F. D.
Norton, E. L.
Powers, H. W. S.
Rehberger, G. E.
Sayler, J. A.
Smith, R. T.
Spencer, E. M.
Stein, J. S.
Struth, O. A.
Tyler, J. E.
West, A. P.
Whitman, H. S.
Wolf, M. W.

German. (107 Students).

Classes meet in McCoy Hall.

Advanced Courses.

German Seminary: *Walther von der Vogelweide:* Professor WOOD. Tuesday, Thursday, Friday, 9 a. m., Room 4. (12).

Farr, J. M.
Fowler, T. H.
Glascock, C. C.
Hagen, S. N.
Hicks, F. C.
Hofmann, J.
Kurrelmeyer, W.
Lyon, C. E.
Miles, L. W.
Parham.
Schneider, J. P.
Stidman, A. G.

Germanic Society: Professor WOOD. Fortnightly, Friday, 4–6 p. m., Room 4. (15).

Blake, F. R.
Farr, J. M.
Fowler, T. H.
Glascock, C. C.
Hagen, S. N.
Hicks, F. C.
Hofmann, J.
Hullihen, W.
Kurrelmeyer, W.
Lyon, C. E.
Miles, L. W.
Ness, J. A.
Schneider, J. P.
Stidman, A. G.
Wilkens, F. H.

Gothic: Professor WOOD. Wednesday and Friday, 10 a. m., Room 4. (7).

Farr, J. M.
Fowler, T. H.
Hicks, F. C.
Lyon, C. E.
Miles, L. W.
Ness, J. A.
Schneider, J. P.

Old Norse: Professor WOOD. Wednesday and Friday, 12 m., Room 4. (7).

Blake, F. R.
Farr, J. M.
Glascock, C. C.
Hofmann, J.
Kurrelmeyer, W.
Lyon, C. E.
Schneider, J. P.

Old High German: *Otfrid:* Professor WOOD. Wednesday, 9 a. m., Room 4. (11).

Blake, F. R.
Brown, G. D.
Farr, J. M.
Fowler, T. H.
Glascock, C. C.
Hagen, S. N.
Hicks, F. C.
Hofmann, J.
Kurrelmeyer, W.
Lyon, C. E.
Schneider, J. P.

History of Rime in Old and Middle High German: Associate Professor VOS. Friday, 3 p. m., Room 6. (7).

Fowler, T. H.
Glascock, C. C.
Hagen, S. N.
Hicks, F. C.
Kurrelmeyer, W.
Schneider, J. P.
West, H. S.

Vondel as Lyric Poet: Associate Professor VOS. Tuesday, 10 a. m., Room 6. (2).

Hofmann, J.
Kurrelmeyer, W.

Contemporary German Drama: Dr. BAKER. Monday, 1 p. m., Room 8. (5).

Foster, H. B.
Hicks, F. C.
Lyon, C. E.
Schneider, J. P.
Stidman, A. G.

Major Course.

History of German Literature: Associate Professor VOS. Monday; ***Schiller,*** *Wallenstein:* Professor WOOD. Tuesday and Friday; ***Prose Composition:*** Professor WOOD and Mr. HOFMANN. Thursday, 11 a. m., Room 6. (18).

Bouchelle, B. N.
Braun, J.
Breed, A. A.
Ember, A.
Greene, J. D.
Griffin, J. W.
Hollander, L. M.
Leopold, E. J.
Mackall, L. L.
Miller, H. C.
Morse, R. B.
Roulston, R. B.
Schneider, J. P.
Taneyhill, G. L.
Turnbull, B.
Vogeler, C. A.
Wight, C.
Winslow, N.

Minor Course A.

Prose Composition: Professor WOOD. Monday; ***Prose Readings and Classics:*** Associate Professor VOS. Tuesday, Thursday, Friday, 11 a. m., Room 11. (33).

Abercrombie, R. T.
Baldauf, L. K.
Bandel, J. M.
Bernheim, B. M.
Bird, A. R.
Boyer, N.
Brown, E. B.
Bruton, A. W.
Bye, M.
Byrne, H. S.
Constantine, C. W.
Cook, T. G.
Fishach, L. G.
Harris, W. H.
Hatch, E. C.
Hazen, H. H.
James, W. McC.
Kohn, W. I.
Lowndes, E.
Norton, E. L.
Rehberger, G. E.
Rehberger, J. M.
Riggins, J. A.
Sayler, J. A.
Shreve, O. F.
Smith, R. T.
Strouse, E.
Struth, O. A.
Swindell, W. B.
Tyler, J. E.
West, A. P.
Whitman, H. S.
Wolf, M. W.

Minor Course B.

von Moser, *Der Bibliothekar;* ***Goethe,*** *Egmont:* Dr. BAKER. Daily, except Wednesday, 11 a. m., Room 8. (8).

Beck, G. C.
Burrell, J. L. A.
Chatard, J. A.
Hood, F.
Liddell, D. M.
Mower, F. D.
Powers, H. W. S.
Purcell, T. N. D.

Elementary German: Associate Professor VOS. Tuesday, Wednesday, Friday, 9 a. m., Room 6. (8).

Fenwick, B. L.
Gould, W. E.
Griffith, W. A.
Hill, W. B.
Lilly, W. L.
Lisberger, S. J.
Mower, McH.
Weaver, C. C.

Elective Courses.

Readings in Contemporary German Literature: *Wildenbruch, Der Letzte; Ebner-Eschenbach, Miterlebtes:* Dr. BAKER. Monday, 9 a. m., Tuesday, 10 a. m., Room 8. (4).

Hollander, L. M.
Jungbluth, K.
Kalb, J. A.
Smull, M. N.

Scientific Readings: *Brandt and Day, German Scientific Readings; Cohn, Ueber Bakterien; Helmholtz, Ueber Goethe's Naturwissenschaftliche Arbeiten:* Dr. BAKER. Thursday, 12 m., Room 8; Friday, 1 p. m., Room 10. (7).

Greenbaum, H. S.
Haskell, L. W.
Jungbluth, K.
Jungbluth, M.
Keidel, A.
Lazenby, M.
Robinson, G. C.

Special Courses.

Historical German: (*For Graduate Students*): Mr. W. KURRELMEYER. Tuesday and Thursday, 5 p. m., Room 6. (6).

Beardsley, W. F.
Foote, T. C.
Guernsey, R.
Haywood, R. W.
McWhorter, A. W.
Smith, C. S.

Scientific German: *Dippold, Scientific German Reader:* (*For Graduate Students*): Mr. HOFMANN. Monday and Thursday, 5 p. m., Room 8. (6).

Clark, F. E.
Coble, A. B.
Douglas, J. M.
Loving, R. E.
Meyer, J. F.
Ragland, G.

Oral Exercises: Mr. HOFMANN. Tuesday, 5 p. m., Room 8. (6).

Fosnocht, E. B.
Fowler, T. H.
Lyon, C. E.
Miles, L. W.
Schneider, J. P.
Stidman, A. G.

.oe Languages. (74 Students).

Classes meet in McCoy Hall.

Courses.

nce Seminary: Professor ELLIOTT. Tuesday, 11 a. m. to ı., Room 2. (7).

der, J. D.
P. J.
Gould, W. E.
Mosemiller, C. A.
Nitze, W. A.
Shaw, J. E.
Stidman, A. G.

ch Dialects: Professor ELLIOTT. Monday, 11 a. m., Room 2. (5).

lder, J. D.
, P. J.
Gould, W. E.
Mosemiller, C. A.
Shaw, J. E.

ch Phonology: Dr. ARMSTRONG. Monday, Tuesday, Thursday, a. m., Room 2. (11).

helder, J. D.
er, H. V.
, J. M.
Glascock, C. C.
Gould, W. E.
Lyon, C. E.
Mosemiller, C. A.
Shaw, J. E.
Stidman, A. G.
Teillard, X.
Wharey, J. B.

onetics and French Pronunciation: Dr. RAMBEAU. Monay, 9 a. m., Room 7. (6).

tchelder, J. D.
own, G. D.
Canter, H. V.
Gould, W. E.
Hicks, F. C.
Mosemiller, C. A.

ld French Readings: Dr. R. H. WILSON. Monday and Wednesday, 3 p. m., Room 2. (8).

atchelder, J. D.
rown, G. D.
Canter, H. V.
Gould, W. E.
Hicks, F. C.
Miles, L. W.
Rubenstein, C. A.
Stidman, A. G.

istorical French Syntax: Dr. R. H. WILSON. Tuesday and Thursday, 3 p. m., Room 2. (3).

Frein, P. J.
Mosemiller, C. A.
Shaw, J. E.

The French Novel (XIX Century): Dr. OGDEN. Friday, 11 a. m., Room 2. (11).

Batchelder, J. D.
Brown, G. D.
Frein, P. J.
Hagen, S. N.
Hicks, F. C.
Miles, L. W.
Mosemiller, C. A.
Nitze, W. A.
Parham, D. P.
Shaw, J. E.
Stidman, A. G.

French Conversation: Mr. TEILLARD. Thursday, 4 p. m., Room 2. (1).

Stidman, A. G.

Popular Latin: Professor ELLIOTT. Monday, 12 m., Room 2. (4).

Batchelder, J. D.
Gould, W. E.
Mosemiller, C. A.
Stidman, A. G.

Dante: (*Lectures*): Professor ELLIOTT. Wednesday, 12 m., Room 2. (5).

Batchelder, J. D.
Gould, W. E.
Rubenstein, C. A.
Shaw, J. E.
Stidman, A. G.

Historical Italian Grammar: Dr. ARMSTRONG. Wednesday and Friday, 10 a. m., Room 6. (1).

Shaw, J. E.

Spanish Philology: Dr. MARDEN. Wednesday and Friday, 10 a. m., Room 2. (3).

Batchelder, J. D.
Gould, W. E.
Mosemiller, C. A.

Beginnings of Spanish Literature: Dr. MARDEN. Thursday, 11 a. m., Room 2. (5).

Batchelder, J. D.
Gould, W. E.
Mosemiller, C. A.
Rubenstein, C. A.
Teillard, X.

Old Spanish Readings: Dr. MARDEN. Friday, 12 m., Room 2. (3).

Batchelder, J. D.
Gould, W. E.
Mosemiller, C. A.

Romance Palæography: Dr. KEIDEL. Thursday, 12 m., Room 2. (7).

Batchelder, J. D.
Frein, P. J.
Gould, W. E.
Mosemiller. C. A.
Rubenstein, C. A.
Stidman, A. G.
Teillard, X.

Romance Club: Professor ELLIOTT. Wednesday, 11 a. m., Room 2. (13).

Armstrong, E. C.
Batchelder, J. D.
Frein, P. J.
Gould, W. E.
Keidel, G. C.
Marden, C. C.
Mosemiller, C. A.
Nitze, W. A.
Ogden, P.
Rubenstein, C. A.
Shaw, J. E.
Stidman, A. G.
Wilson, R. H.

Romans d'Antiquité: Dr. F. M. WARREN. Monday, Tuesday, Wednesday, 11 a. m., Thursday, 12 m., Friday, 9 a. m., Room 2. (During February). (9).

Batchelder, J. D.
Frein, P. J.
Gould, W. E.
Keidel, G. C.
Mosemiller, C. A.
Nitze, W. A.
Rubenstein, C. A.
Shaw, J. E.
Stidman, A. G.

Realism and Naturalism in French Literature: Dr. F. M. WARREN. Tuesday, Thursday, Friday, 5 p. m., Donovan Room; Tuesday, 12 m., Room 2. (During February). (11).

Batchelder, J. D.
Canter, H. V.
Frein, P. J.
Gould, W. E.
Hicks, F. C.
Lyon, C. E.
Mosemiller, C. A.
Nitze, W. A.
Rubenstein, C. A.
Shaw, J. E.
Stidman, A. G.

ndergraduate Courses.

French: (*Major Course*): Associate Professor RAMBEAU. Daily, except Tuesday, 10 a. m., Room 7. (6).

G. D.
Fosnocht, E. B.
Jones, T. D.
Kurrelmeyer, H.
Turnbull, B.

French: (*Minor Course, Class A*): Associate Professor RAMBEAU. except Thursday, 12 m. (17).

Abercrombie, R. T.
Beeuwkes, C. J.
Brady, J. H.
Flinn, F. B.
Glaser, O. C.
Greene, J. D.
Griffin, E. J.
Harris, W. H.
Hill, W. B.
Homer, H. L.
Lindheim, N. R.
Mackall, L. L.
Moore, J. S.
Powell, M.
Smith, W.
Taneyhill,
Wharey, J

French: (*Minor Course, Class B*): Dr. OGDEN. Daily, except day, 12 m., Room 6. (18).

Bogue, H.
Brooks, C. E.
Chambers, L. M.
Clark, C. T.
DeGrange, M.
Fisher, F. C.
French, J. C.
Greenbaum, H. S.
Kerr, R. C.
King, J. H.
Marshall, T. H.
Martin, W. E.
Moore, J. H.
Perkins, H. F.
Ross, W. I
Spilman,
Wirt, C. B
Wright, A.

French: (*Elementary Course*): Dr. ARMSTRONG. Tuesday, Wed Friday, 9 a. m., Room 10. (3).

Hazen, H. H.
Murkland, P. A.
Stephens, J. L.

French: (*Elective Course*):

Section I: Dr. KEIDEL. Monday and Wednesday, 12 m., Room 12

Bouchelle, B. N.
Roulston, R. B.
Taveau, R.
Werber, O.

Section II: Dr. OGDEN. Monday, 9 a. m., Room 10; Thursday, 1 Room 2. (6).

Bruce, E. S.
Guggenheimer, C. M.
Harwood, S. P.
Krager, W. M.
Mullen, J. M.
Peters, J.

Italian: (*Minor Course*): Associate Professor RAMBEAU. Daily, Monday, 9 a. m., Room 7. (1).

Wight, C.

Italian: (*Elective Course*): Dr. R. H. WILSON. Wednesday and day, 1 p. m., Room 4. (1).

Davidson, G. D.

Spanish: (*Minor Course*): Dr. MARDEN. Daily, except M 9 a. m., Room 8. (4).

Bouchelle, B. N.
Canter, H. V.
Schermerhorn, A. V. R.
Taveau, R

Spanish: (*Elective Course*): Dr. MARDEN. Monday, 9 a. m Wednesday 1 p. m., Room 12. (5).

Glascock, C. C.
Kurrelmeyer, H.
Parham, D. P.
Rubenstein, C. A.
Wharey, J.

History, Politics, and Economics. (119 Stud

Classes meet in McCoy Hall.

Historical Seminary: Professor ADAMS. Alternate Fridays Room 25. (28).

Adams, T. S.
Arnold, B. W.
Boggs, W. J.
Brander, W. W.
Campbell, H.
Dickerson, E. T.
Drewry, W. S.
Freeman, A. T.
Garrett, R.
Groome, P. L.
Marston, O. J.
Martin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S.
Persinger, C. E.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Sioussat, St. G. L.
Smith, V
Snavely
Somme
Sumwa
Thom,
Tyler,
Weave

Germanic History: Professor ADAMS. Wednesday and 11 a. m., Room 25. (30).

Arnold, B. W.
Boggs, W. J.
Brander, W. W.
Campbell, H.
Dawson, J.
Dickerson, E. T.
Drewry, W. S.
Freeman, A. T.
Garrett, R.
Hicks, F. C.
Hood, F.
Marston, O. J.
Martin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S
Persinger, C. E.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Schneider, J. P.
Sioussat, St. G. L.
Smit
Snav
Som
Sum
Thc
Tyl
We

Nineteenth Century: Professor ADAMS. Friday, 11 a. (30).

Adams, T. S.
Boggs, W. J.
Brander, W. W.
Campbell, H.
Clarke, G. M.
Dawson, J.
Drewry, W. S.
Freeman, A. T.
Garrett, R.
Groome, P. L.
Guthrie, C. E.
Marston, O. J.
Martin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S.
Palmer, J. H.
Persinger, C. E.
Radcliffe, G. L. P.
Renouf, V. A.
Schmeckebier, L. F.
Sioussat, St. G. L.
S
S
S

History of Civilization: (*Major History*): Professo day and Tuesday, 11 a. m., Room 24. (32).

Beeuwkes, C. J.
Boggs, W. J.
Brady, J. H.
Clark, C. T.
DeGrange, M.
Dickerson, E. T.
Ford, C. E.
Foster, F.
Garrett, R.
Grasty, J. S.
Heyman, S.
Hill, H. D.
Hill, J. P.
Homer, H. L.
Lindheim, N. R.
Marshall, T. H.
Marston, O. J.
Martin, W. E.
Miller, R. D.
Moore, J. S.
Palmer, J. H.
Persinger, C. E.
Renouf, V. A.
Schermerhorn, A. V

Historical Conference: Associate Professor V Tuesdays, 3–5 p. m., Room 23. (10).

Drewry, W. S.
Groome, P. L.
Motley, D. E.
Radcliffe, G. L. P.
Renouf, V. A.
Sioussat, St. G. L.
Sommerville, C.
Sumwalt, J. W.

ial and Economic Europe: Associate Professor VINCENT. esday and Thursday, 10 a. m., Room 23. (18).

old, B. W.
wry, W. S.
ome, P. L.
ston, O. J.
tin, W. E.
McBryde, M. B.
Miller, R. D.
Motley, D. E.
Myers, W. S.
Persinger, C. E.
Radcliffe, G. L. P.
Schmeckebier, L. F.
Sioussat, St. G. L.
Snavely, C.
Sommerville, C.W.
Sumwalt, J. W. R.
Thom, W. T.
Weaver, C. C.

ropean History: (*Major History*): Associate Professor VINCENT. ursday and Friday, 11 a. m., Room 23. (21).

uwkes, C. J.
dy, J. H.
k, C. T.
range, M.
d, C. E.
ter, F.
Grasty, J. S.
Heyman, S.
Hill, H. D.
Hill, J. P.
Homer, H. L.
Lindheim, N. R.
Marshall, T. H.
Moore, J. S.
Schermerhorn, A. V. R.
Shriver, W. P.
Smith, W. L.
Spencer, E. M.
Stephens, C. G.
Wingert, M.
Wright, H. C.

torical Politics: (*History-Economics Course*): Associate Professor INCENT. Monday and Wednesday, 10 a. m., Room 23. (21).

ne, H.
chelle, B. N.
mbers, L. M.
nin, F. H.
ber, A.
ner, F. C.
Flinn, F. B.
French, J. C.
Kalb, J. A.
King, J. H.
Lazenby, M.
Liddell, D. M.
Palmer, J. H.
Remsen, C. M.
Ross, W. L.
Smull, M. N.
Spilman, E. A.
Stein, J. S.
Thomas, R. H.
Ver Planck, De L.
Winslow, N.

erican Economic History: Dr. BALLAGH. Tuesday, 11 a. m., oom 20. (7).

oold, B. W.
nder, W. W.
Drewry, W. S.
Hicks, F. C.
McBryde, M. B.
Motley, D. E.
Sommerville, C.W.

nicipal and Local Government: Dr. BALLAGH. Thurs- y, 1 p. m., Room 20. (6).

Bryde, M. B.
singer, C. E.
Radcliffe, G. L. P.
Rayner, A. W.
Tyler, J. C.
Weaver, C. C.

neral History Examinations: Dr. BALLAGH. Friday, 12 m., oom 20. (7).

tley, D. E.
singer, C. E.
Schmeckebier, L. F.
Sioussat, St. G. L.
Snavely, C.
Sommerville, C. W.
Thom, W. T.

uthern History: Dr. BALLAGH. Friday, 3 p. m., Room 20. (7).

ewry, W. S.
oome, P. L.
Martin, W. E.
Motley, D. E.
Radcliffe, G. L. P.
Sommerville, C. W.
Weaver, C.

ssical and Early European History: (*Minor History*): Dr. ALLAGH. Daily, except Tuesday, 10 a. m., Room 20. (16).

rnheim, B. M.
yer, N.
dy, J. H.
own, E. B.
Byrne, H. S.
Duck, R. S.
Griffin, E. J.
Harris, W. H.
Harwood, S. P.
Kohn, W. I.
Murkland, P. A.
Norton, E. L.
Raffel, H. B.
Sayler, J. A.
Tyler, J. E.
Whitman, H. S.

litical Conference: Dr. WILLOUGHBY. Alternate Thursdays, -10 p. m., Room 20. (3).

ams, T. S.
Radcliffe, G. L. P.
Weaver, C. C.

ited States Constitutional Law: Dr. WILLOUGHBY. Monday nd Tuesday, 12 m., Room 20. (7).

nold, B. W.
nder, W. W.
Clarke, G. M.
Marston, O. J.
McBryde, M. B.
Palmer, J. H.
Tyler, J. C.

gal Aspect of Economic and Industrial Problems: Dr. ILLOUGHBY. Wednesday and Thursday, 12 m., Room 20. (11).

ms, T. S.
nold, B. W.
nder, W. W.
Campbell, H.
Clarke, G. M.
Myers, W. S.
Palmer, J. H.
Radcliffe, G. L. P.
Sioussat, St. G. L.
Sommerville, C.W.
Weaver, C. C.

erican Political and Constitutional History: (*Major olitics*): Dr. STEINER. Monday and Tuesday, 12 m., Room 24. (33).

ckiston, A. H.
gs, W. J.
ed, A. A.
ce, E. S.
npbell, H.
kerson, E. T.
wnes, H. C.
ewry, W. S.
oks, W. M.
Frank, S. W.
Gaddess, C. C.
Grimes, R. H.
Guggenheimer, C. M.
Hanna, H. S.
Harwood, S. P.
Jones, T. D.
Joyner, L. L.
Jungbluth, K.
Kalb, J. A.
Keidel, A.
Knapp, G. W.
Krager, W. M.
Levering, J.
Mullen, J. M.
Murkland, P. A.
Peters, J. G.
Radcliff, W.
Rayner, A. W.
Renouf, V. A.
Reymann, L. A.
Robinson, G. C.
Ver Planck, De L.
Weaver, C. C.

story of English Law: Dr. LEE. Friday, 10 a. m., Room 24. (15).

llard, Z. M.
ckiston, A. H.
gs, W. J.
rke, G. M.
Dickerson, E. T.
Ensor, J. T.
Groome, P. L.
Ingram, C.
Martin, W. E.
Persinger, C. E.
Radcliff, W.
Radcliffe, G. L. P.
Schmeckebier, L. F.
Tyler, J. C.
Weaver, C. C.

glish Political and Constitutional History: (*Major Poli- ies*): Dr. LEE. Wednesday and Friday, 12 m., Room 24. (36).

ckiston, A. H.
ggs, W. J.
red, A. A.
uce, E. S.
arke, G. M.
ckerson, E. T.
wnes, H. C.
ner, J. T.
oks, W. M.
Frank, S. W.
Gaddess, C. C.
Grimes, R. H.
Groome, P. L.
Guggenheimer, C. M.
Guthrie, C. E.
Hanna, H. S.
Harwood, S. P.
Ingram, C.
Jones, T. D.
Joyner, L. L.
Jungbluth, K.
Kalb, J. A.
Keidel, A.
Knapp, G. W.
Krager, W. M.
Levering, J.
Mullen, J. M.
Murkland, P. A.
Persinger, C. E.
Peters, J. G.
Radcliff, W.
Renouf, V. A.
Reymann, L. A.
Robinson, G. C.
Smith, V. E.
Tyler, J. C.

nomic Seminary: Associate Professor SHERWOOD and Dr. HOLLANDER. Thursday, 4–6 p. m., Room 21. (12).

ms, T. S.
pbell, H.
erson, E. T.
Drewry, W. S.
Freeman, A. T.
Marston, O. J.
Martin, W. E.
Myers, W. S.
Renouf, V. A.
Schmeckebier, L. F.
Smith, V. E.
Tyler, J. C.

lation of Economics to Law: Associate Professor SHERWOOD. onday, 9 a. m., Room 24. (11).

ms, T. S.
ckiston, A. H.
nder, W. W.
Campbell, H.
Clarke, G. M.
Dickerson, E. T.
Freeman, A. T.
Marston, O. J.
Martin, W. E.
Renouf, V. A.
Tyler, J. C.

Money: Associate Professor SHERWOOD. Thursday and Friday, 9 a. m., Room 24. (18).

Adams, T. S.
Brander, W. W.
Campbell, H.
Clarke, G. M.
Dickerson, E. T.
Drewry, W. S.
Freeman, A. T.
Garrett, R.
Groome, P. L.
Marston, O. J.
Martin, W. E.
Miller, R. D.
Myers, W. S.
Palmer, J. H.
Persinger, C. E.
Renouf, V. A.
Smith, V. E.
Tyler, J. C.

History and Theory of Crises: Dr. HOLLANDER. Tuesday and Wednesday, 9 a. m., Room 24. (14).

Adams, T. S.
Brander, W. W.
Campbell, H.
Clarke, G. M.
Dickerson, E. T.
Drewry, W. S.
Groome, P. L.
Martin, W. E.
Miller, R. D.
Myers, W. S.
Persinger, C. E.
Renouf, V. A.
Smith, V. E.
Tyler, J. C.

Recent Economic Theories: (*Elective Course*): Associate Professor SHERWOOD. Thursday, 12 m., Friday, 1 p. m., Room 21. (16).

Campbell, H.
Dickerson, E. T.
Downes, H. C.
Fooks, W. M.
Gaddess, C. C.
Hanna, H. S.
Jones, T. D.
Joyner, L. L.
Knapp, G. W.
Marston, O. J.
Miller, R. D.
Rayner, A. W.
Renouf, V. A.
Reymann, L. A.
Tyler, J. C.
Ver Planck, De L.

Money and Banking: (*History-Economics Course*): Dr. HOLLANDER. Thursday and Friday, 10 a. m., Room 24. (19).

Bogue, H
Bouchelle, B. N.
Chambers, L. M.
Cronin, F. H.
Ember, A.
Fisher, F. C.
Flinn, F. B.
French, J. C.
Kalb, J. A.
King, J. H.
Lazenby, M.
Liddell, D. M.
Remsen, C. M.
Ross, W. L.
Smull, M. N.
Spilman, E. A.
Stein, J. S.
Thomas, R. H.
Winslow, N.

Money and Banking: (*Minor Course*): Dr. HOLLANDER. Thursday and Friday, 10 a. m., Room 24. (21).

Beeuwkes, C. J.
Boggs, W. J.
Bruce, E. S.
Clark, C. T.
DeGrange, M.
Ford, C. E.
Gemmill, J. R.
Grasty, J. S.
Grimes, R. H.
Heyman, S.
Hill, J. P.
Lindheim, N. R.
Marshall, T. H.
Moore, J. S.
Mullen, J. M.
Peters, J. G.
Schermerhorn, A. V. R.
Shriver, W. P.
Spencer, E. M.
Stephens, C. G.
Wingert, M.

International Trade: (*Minor Course*): Dr. HOLLANDER. Monday and Wednesday, 10 a. m., Room 24. (20).

Beeuwkes, C. J.
Bruce, E. S.
Clark, C. T.
DeGrange, M.
Ford, C. E.
Gemmill, J. R.
Grasty, J. S.
Grimes, R. H.
Heyman, S.
Hill, J. P.
Lindheim, N. R.
Marshall, T. H.
Moore, J. S.
Mullen, J. M.
Peters, J. G.
Schermerhorn, A. V. R.
Shriver, W. P.
Spencer, E. M.
Stephens, C. G.
Wingert, M.

Philosophy. (56 Students).

Classes meet in Room 12, McCoy Hall.

History of Philosophy: (*For Graduate Students*): Professor GRIFFIN. Friday, 4 p. m. (9).

Archibald, H. T.
Ewing, A. H.
Groome, P. L.
Guernsey, R.
Hood, F.
Jones, J. W.
Martin, W. E.
Rabinovitch, I. E.
Weaver, C. C.

Deductive and Inductive Logic: until December 23; ***Psychology:*** January 3 to March 29; ***Ethics:*** after April 5: Professor GRIFFIN. Daily, 11 a. m. ***Outlines of the History of Philosophy:*** Weekly. (48).

Armstrong, J. R. C.
Bogue, H.
Bruce, E. S.
Chambers, L. M.
Davidson, G. D.
Downes, H. C.
Fisher, F. C.
Flinn, F. B.
Fooks, W. M.
Fosnocht, E. B.
Frank, S. W.
French, J. C.
Gaddess, C. C.
Gemmill, J. R.
Greenbaum, H. S.
Grimes, R. H.
Guggenheimer, C. M.
Hanna, H. S.
Harwood, S. P.
Haskell, L. W.
Jones, J. W.
Jones, T. D.
Joyner, L. L.
Jungbluth, K.
Jungbluth, M.
Kalb, J. A.
Keidel, A.
King, J. H.
Knapp, G. W.
Krager, W. M.
Kurrelmeyer, H.
Lazenby, M.
Levering, J.
Mullen, J. M.
Murkland, P. A.
Palmer, E. L.
Peters, J. G.
Remsen, C. M.
Reymann, L. A.
Robinson, G. C.
Ross, W. L.
Routh, J. F.
Smull, M. N.
Spilman, E. A.
Taveau, R.
Thomas, R. H.
Ver Planck, De L.
Werber, O. S.

Drawing. (71 Students).

Classes meet in the Howard Street building.

Freehand Drawing: Mr. WHITEMAN. Tuesday and Thursday, 2–5 p. m., Room 18. (60).

Baldauf, L. K.
Bandel, J. M.
Bird, A. R.
Booker, J. M.
Boyer, N.
Braun, J.
Briscoe, J. S.
Brown, E. B.
Bruton, A. W.
Bye, M.
Byrne, H. S.
Cook, T. G.
Cronin, F. H.
Dapprich, F. R.
Duck, R. S.
Ember, A.
Fenwick, R. L.
Fishach, L. G.
Griffin, E. J.
Griffith, W. A.
Guggenheimer, C. M.
Harris, W. H.
Hatch, E. C.
Hazen, H. H.
Hill, W. B.
Hollander, L.
James, W. McC.
Kohn, W. I.
Leopold, E. J.
Lilly, W. L.
Lisberger, S. J.
Lowndes, E.
Machen, J. G.
Miller, H. C.
Morse, R. B.
Mower, F. D.
Mower, McH.
Noble, E. R.
Norton, E. L.
Powers, H. W. S.
Preston, J. O.
Raffel, H. B.
Rehberger, G. E.
Riggins, J. A.
Sayler, J. A.
Shreve, O. F.
Smith, R. T.
Spencer, L. C.
Stein, J. S.
Stephens, J. L.
Straus, H. P.
Strouse, E.
Struth, O. A.
Swindell, W. B.
Tyler, J. E.
Vogeler, C. A.
Warner, H. M.
West, A. P.
Wolf, M. W.
Zies, F.

Mechanical Drawing: Mr. GEER. Thursday and Friday, 2–5 p. m., Room 9. (11).

Armstrong, J. R. C.
Beale, R. B.
Beeuwkes, R. K.
Everett, W. T.
Estill, H. S.
Fitzgerald, T.
Illmer, L.
Nightingale, C. E.
Pender, H.
Schoepf, F. H.
Swaine, J. W.

Forensics and Public Speaking. (151 Students).

Classes meet in McCoy Hall.

Debate and Parliamentary Practice: *Third Year* (*Senate*): Dr. Lee. Wednesday, 11 a. m., Donovan Room. (44).

Armstrong, J. R. C.
Bogue, H.
Bruce, E. S.
Chambers, L. M.
Davidson, G. D.
Downes, H. C.
Fisher, F. C.
Flinn, F. B.
Fooks, W. M.
Fosnocht, E. B.
Frank, S. W.
French, J. C.
Gaddess, C. C.
Gemmill, J. R.
Greenbaum, H. S.
Grimes, R. H.
Guggenheimer, C. M.
Hanna, H. S.
Haskell, L. W.
Jones, T. D.
Joyner, L. L.
Jungbluth, K.
Kalb, J. A.
Keidel, A.
King, J. H.
Knapp, G. W.
Krager, W. M.
Kurrelmeyer, H.
Lazenby, M.
Levering, J.
Mullen, J. M.
Murkland, P. A.
Peters, J. G.
Remsen, C. M.
Reymann, L. A.
Robinson, G. C.
Ross, W. L.
Smull, M. N.
Spilman, E. A.
Taveau, R.
Thomas, R. H.
Ver Planck, De L.
Werber, O. S.
Wright, A.

Conference in Parliamentary Practice: Dr. Lee. Monday, 1 p. m., Thursday, 5 p. m., Saturday, 10 a. m., Donovan Room. (11).

Chambers, L. M.
Davidson, G. D.
Fisher, F. C.
French, J. C.
Greenbaum, H. S.
Grimes, R. H.
Guggenheimer, C. M.
Jones, T. D.
King, J. H.
Murkland, P. A.
Reymann, L. A.

Debate and Parliamentary Law: *Second Year* (*House of Representatives*): Dr. Lee. Thursday, 12 m., Donovan Room. (45).

Abercrombie, R. T.
Anderson, R. B. T.
Baetjer, H.
Beeuwkes, C. J.
Bouchelle, B. N.
Brady, J. H.
Breed, A. A.
Brooks, C. E.
Burrell, J. L. A.
Clark, C. T.
DeGrange, M.
Eager, J. H.
Ewell, J. E.
Flinn, F. B.
Ford, C. E.
Foster, F.
Francis, I. H.
Glaser, O. C.
Greene, J. D.
Griffin, J. W.
Heyman, S.
Hill, H. D.
Hill, J. P.
Hyde, E. P.
Kerr, R. C.
Liddell, D. M.
Lindheim, N. R.
Mackall, L. L.
Marshall, T. H.
McAll, R. L.
Moore, J. S.
Powell, M. W.
Purcell, T. N. D.
Roulston, R. B.
Rous, F. P.
Routh, J. E.
Schermerhorn, A. V. R.
Shriver, W. P.
Smith, W. L.
Stephens, C. G.
Taneyhill, G. L.
Whitman, H. S.
Wight, C.
Wingert, M.
Wright, H. C.

Conference in Parliamentary Law: Dr. Lee. Tuesday, 1 p. m., Thursday, 8 a. m., Saturday, 9 a. m., Donovan Room. (11).

Beeuwkes, C. J.
Foster, F.
Greene, J. D.
Griffin, J. W.
Hill, J. P.
Hyde, E. P.
Liddell, D. M.
Lindheim, N. R.
McAll, R. L.
Shriver, W. P.
Wingert, M.

Public Speaking: *First Year:* Dr. Lee. Assembly Room. Wednesday, 1 p. m. (19).

Baldauf, L. K.
Bird, A. R.
Brown, E. B.
Byrne, H. S.
Cronin, F. H.
Duck, R. S.
Fenwick, B. L.
Hatch, E. C.
Homer, H. L.
Kohn, W. I.
Lilly, W. L.
Lisberger, S. J.
Miller, H. C.
Morse, R. B.
Mower, McH.
Riggins, J. A.
Shreve, O. F.
Spencer, E. M.
Vogeler, C. A.

Thursday, 1 p. m. (22).

Bandel, J. M.
Bernheim, B. M.
Boyer, N.
Bruton, A. W.
Constantine, C. W.
Dapprich, F. R.
Griffith, W. A.
Hazen, H. H.
Hill, W. B.
Norton, E. L.
Raffel, H. B.
Rehberger, G. E.
Sayler, J. A.
Smith, R. T.
Stein, J. S.
Stephens, J. L.
Strouse, E.
Struth, O. A.
Swindell, W. B.
Turnbull, B.
Tyler, J. E.
Zies, F.

Friday, 1 p. m. (21)

Booker, J. M.
Braun, J.
Briscoe, J. S.
Bye, M.
Cook, T. G.
Ember, A.
Fishach, L. G.
Griffin, E. J.
Harris, W. H.
Hollander, L. M.
James, W. McC.
Leopold, E. J.
Lowndes, E.
Machen, J. G.
Manken, H.
Mower, F. D.
Noble, E. R.
Powers, H. W. S.
Spencer, L. C.
Straus, H. P.
Warner, H. M.

Forensics: *First Year* (*Limited Class*): Dr. Lee. Monday, Wednesday, Friday, 5 p. m., Donovan Room. (13)

Bird, A. R.
Boyer, N.
Briscoe, J. S.
Byrne, H. S.
Cook, C. G.
Machen, J. G.
Noble, E. R.
Spencer, E. M.
Spencer, L. C.
Straus, H. P.
Swindell, W. B.
Tyler, J. E.
Wolf, M. W.

STUDENTS IN THE JOHNS HOPKINS MEDICAL

Candidates for the Degree of M. D. (196).

Fourth Year. (33).

Brownell, E. E.
Buckler, H. W.
Cole, R. I.
Davis, F. C.
Davis, J. S.
Emerson, C. P.
Epler, B. N.
Erlanger, J.
Evans, P. S., Jr.
Follis, R. H., Jr.
Fulton, F. T.
Gallagher, J. D.
Harris, H.
Hoye, H. J.
Ladd, L. W.
Little, C. S.
Luetscher, J. A.
Lupton, F. A.
Lynch, F. W.
Magee, C. L.
Moore, H. M.
Ottley, C. W.
Owsley, P. O.
Pleasants, J. H., Jr.
Rosenheim, S.
Samp
Steen
Stone
Strob
Verh
Willi
Wych
Yate

Third Year. (43).

Akerman, J.
Allen, H. W.
Austin, M. F.
Beale, A. E.
Bettman, M.
Briggs, E.
Brülle, H.
Burnam, C. F.
Chace, E. S.
Chittenden, A. S.
Christian, H. A.
Dancy, W. R.
Eggers, A. H.
Evans, H. C.
Fairbank, R.
Farrar, C. B.
Fisher, A. L.
Fisher, W. A., Jr.
Fletcher, H.
Flint, J. M.
Healy, W. P.
Hendrickson, W. F.
Hewlett, A. W.
Kellogg, W. C.
Kyes, P.
Lebus, L.
Lewis, W. H.
Little, H. W.
Lowell, E. L.
MacCallum, J. B.
Marvell, M. W.
Meltzer, C. R.
Mosher, C. D.
Myri
Rand
Reed,
Rusk
Sabin
Sowe
Stone
Warr
West,
Wool

Second Year. (58).

Atherton, A. M.
Baetjer, F. H.
Baldwin, W. D.
Berry, J. M.
Blakeslee, W. H.
Bloombergh, H. D.
Boggs, T. R.
Bosley, J. R.
Bunting, C. H.
Butler, J. I.
Carey, H. W.
Chowning, W. M.
Comer, R. T.
Connor, G. L.
Connor, R.
Drake, G. S., Jr.
Dutcher, A.
Fowler, H. A,
Gay, F. P.
Graham, N. D.
Hall, G. W.
Hamman, L. V.
Hastreiter, R. F.
Hathaway, J. H.
Hitzrot, J. M.
Holden, G. R.
Hume, E. H.
Johnston, W. B.
Kaufman, H. M.
Lamson, T.
Lewis, D. M.
Long, M.
Longcope, W. T.
Lyle, A. G.
Maddren, W. H.
McKeough, E. P.
Moore, E. S.
Parker, H. P.
Pullen, F. K.
Rubel, M. J.
Rushmore, S.
Salter, J. C.
Simis, M. P.
Slemons, J. M.
Smit
Sprat
Stein
Stein
Swet
Ulric
Unde
Walk
Warf
Warr
Watt
Well
Well
Win

First Year. (62).

Auer, J.
Briggs, J. B., Jr.
Browne, B. B.
Bruns, R. M.
Bryan, W. M. C.
Bush, C.
Chase, L. A.
Churchman, J. W.
Clarke, T. W.
Cook, H. W.
Coons, J. J.
Cooper, J. C.
Dohme, G. C.
Dolley, D. H.
Dudley, H.
Duffy, R.
Dunlop, J.
Eddy, D. L.
Erving, W. G.
Ferry, N. S.
Fogle, C. V.
Foster, N. B.
Francis, W. W.
Frankenthal, M. A.
Geraghty, J. T.
Glenny, W. H.
Grant, J. F.
Haviland, M. L.
Haynes, M. S.
Hirshberg, L. K.
Horst, C. H.
Hyman, S.
Jelke, W. F.
Jones, T. M.
Karsted, A.
Lehr, L. C.
L'Engle, E. M.
Lincoln, M. W.
Litchfield, G. V., Jr.
Lootz, E.
Ludlum, S. D.
MacGregor, G. M.
Marshall, S. A.
McFarland, J. S.
Meisenhelder, E. W.
Meisenhelder, J. E.
Ochsner, H. W.
Pelto
Reed
Rigg
Rigg
Roge
Schol
Silve
Simp
Talla
Van
Van
Wigh
Willi
Willi
Wrig

Physicians attending Special Courses. (11).

Carroll, J. J.
Cone, C.
Curtiss, R. M.
Fearn, T.
Greenebaum, E. C.
Johnson, E. K.
Lee, T. S.
Mason, D.
Reuling, R.
Rich.
Smit

During the months of May and June, 1898, the Special
Graduates in Medicine were attended by 45 physicians. Thei
given in the first edition of the Annual Register, 1898–99.

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The Journal of Experimental Medicine is devoted to original investigations in Physiology, Pathology, Bacteriology, Pharmacology, Physiological Chemistry, Hygiene and Medicine.

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sent on application.

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and will contain over six hundred pages, with numerous illustr

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The Johns Hopkins Pres

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American Chemical Journal.

rnal was commenced in 1879, with Professor Remsen as Editor. olumes of about 450 pages each have been issued, and the st is in progress. Beginning with 1899, this journal will appear Two volumes of six numbers and of about 500 pages each will yearly. Subscription $5 per year. Single number 50 cents.

American Journal of Philology.

publication of this journal commenced in 1889, under the editorial on of Professor Gildersleeve. Eighteen volumes of about 570 pages have been issued, and the nineteenth is in progress. It appears four yearly. Subscription $3 per volume. Single numbers $1. Only a sets remain in the hands of the editor. Price will be stated on ication.

Studies from the Biological Laboratory.

(*Including the Chesapeake Zoölogical Laboratory.*)

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Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Professor H. B. Adams. Sixteen series are now completed and the seventeenth series is in progress. It appears monthly. Subscription $3 per volume. A set of sixteen series, in cloth, will be sold for $48. Eighteen extra volumes have also been issued.

A detailed list of these Studies will be sent on application.

Memoirs from the Biological Laboratory.

These monographs are issued under the editorial direction of Professor W. K. Brooks. Volume IV is in progress. Price of the first three volumes $25.

Johns Hopkins University Circulars.

The publication of these Circulars began in December, 1879, and 138 numbers have since been issued. Subscription $1.00 per year.

Contributions to Assyriology and Comparative Semitic Philology.

The publication of this journal was begun in 1889. Professor Paul Haupt, of the Johns Hopkins University, and Professor Friedrich Delitzsch, of the University of Breslau, are the editors. Volume IV is in progress.

The Johns Hopkins Hospital Reports.

These reports are edited by the Faculty of the Johns Hopkins Medica School and published for the Johns Hopkins Hospital. Their publicatio was begun in 1890. Volume VII is in progress. Price $5 per volume The set of seven volumes will be sold for $35 dollars.

The Johns Hopkins Hospital Bulletin.

The publication of these Bulletins began in 1889. Volume X is progress. They are published monthly. Subscription $1.00 per year. Th set of ten volumes will be sold for $20.

Modern Language Notes.

This journal is edited by Professor A. M. Elliott and his associates in t Modern Language Department. It appears monthly. The fourteen volume is in progress. Subscription $1.50 per year.

The Journal of Experimental Medicine.

This journal is edited by Professor W. H. Welch with the coöperati a number of associates. It appears six times a year. Volume IV progress. Subscription $5.00 per year.

The set of four volumes will be sold for $25.

American Journal of Insanity.

This journal is under the direction of Professor Henry M. Hurd in-chief. It appears quarterly. Subscription $5.00 per year.

Reports of the Maryland Geological Survey.

These reports are under the editorial direction of Professor W Director of the Survey.

The principal separate publications issued by the Johns H are:—

Photograph of the Normal Solar Spectrum. By A. Rowland. Set of ten plates, $20.

A New Critical Edition of the Hebrew Text of th ment. Now in progress. Prospectus on application.

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NOTES FROM THE PHYSICAL LABORATORY.

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he Effect of Temperature, Pressure and Used Solu- ns on the Deposit of Silver Voltameters. By J. F. RRILL.

he object of this investigation was to see if by means of temperature pressure the amount of the electric charge carried by silver ions in the ctrolysis of silver nitrate could be varied. It is well known that the ount of the silver deposit, as obtained in ordinary electrolysis, varies ghtly according to the conditions under which the deposit is obtained. at that this variation is due to any change in the carrying capacity of the lver ions has probably not been proved.

Preliminary experiments having shown that the pressure had to be con-derable if any measurable effect was to be obtained, a piece of apparatus as made by means of which the voltameter could be subjected to a gaseous ressure of 120 atmospheres. The pressure cage was made by boring a hole '' diameter in a piece of steel shafting, threading it, and then screwing down upon a suitably prepared base, up through the bottom of which the nducting wires passed and the gas was admitted. The Rayleigh form of lver voltameter was employed. The Pt. dish was 7 cm., and the silver ode 4 cm. diameter respectively. Two voltameters alike in all respects ere provided, and the deposit under atmospheric conditions compared ith that obtained under pressure. The pressure was secured by admitting mpressed air from a cylinder into the cage.

The following results were obtained :—

No. Experiment.	1	2	3
Pressure in Atmospheres...	103	95	103
Deposit in air................	1.1371	1.23745	1.08205
Deposit under pressure......	1.1370	1.23740	1.08190
Diff. in Deposit..............	0.0001	0.00005	0.00015

The time of deposit was about 32 minutes. According to these results, effect outside of the limits of experimental error was produced.

The effect of air absorbed under pressure was tested, two deposits being ade after the voltameter had stood during several hours under a pressure 90-100 atmospheres. The difference in the deposits as obtained in air d under pressure were 0.00000 and 0.00010 gr. respectively. This result y be reconciled with what Schuster and Crossley (Proc. Roy. Soc., 40, 344, 1892) and Meyers (Wied. Ann., 55, p. 288, 1895) found, that dis-ved gases affect the amount of the deposit, if it is remembered that oxy- n and CO_2 decrease and nitrogen increases the deposit.

To test for a temperature effect it was found necessary to replace the Pt. dish by a Pt. disc suspended horizontally near the top of the electrolyte just as the anode ordinarily is. In this case the anode was at the bottom of the beaker. Here again the two voltameters were alike and were placed in series. The solution in one was boiled and then cooled to the temperature of melting ice and the deposit from this compared with that obtained from a solution maintained at about 90° C. In these experiments the amount of each deposit was about 0.8 gr., the current intensity 0.25–.3 amp., and the kathode discs about 13 sq. cm. in area. The average difference in the deposits was about 1 part in 8000—within experimental error.

This result is apparently not in agreement with four observations made by Rayleigh, who found a difference of about 1 part in 2500 in favor of a solution at 50° C. as compared with one at 4° C.; but it is in agreement with two observations made by Kahle (Zeitschr. für Instr., 8, p. 229, 1898). But if the deposit from the hot solution or from a solution previously boiled and then cooled was compared with that obtained from an unboiled solution, the former seemed to be greater than the latter in amounts varying from 0.00–0.08 per cent.

However, using the Rayleigh form of voltameter the deposit from a boiled and then cooled solution did not differ more than 0.2 mg. from that of a solution not boiled. Though the deposits from cold and hot solutions respectively did not differ in amount, they did differ in character. Those from cold solutions were always fine grained and snowy white in color, while those from hot solutions were more coarsely granular with a tendency toward gray in color.

Next, the deposit from a previously boiled and then cooled water solution was compared with that obtained from fused silver nitrate. The results of the last seven experiments are here given :—

Temp. of fused Ag. NO_3...	260°	255°	250°	245°	243°	242°	243°
Solution deposit............	0.7224	0.7307	0.90250	0.79955	0.8511	0.88965	0.9068
Fusion deposit..............	0.7230	0.73075	0.90285	0.79955	0.85115	0 89080	0.90665
Diff..........................	0.0006	0.00005	0.00035	0.00000	0.00005	0.00125	0.00015

Though these results show a difference in favor of the deposit from the fusion, yet this is probably accidental and due to some particles of foreign matter that could not be washed off; for there was always more or less of a scum floating on the surface of the fused silver nitrate, some of which adhered to the kathode when removed.

Two different series of tests were made on the relative deposits from fresh and "used" solutions, the voltameters (Rayleigh form) being alike in all respects. The first "used" solution tested was made on November 27, its volume was 300 cc., contained 15 per cent. silver nitrate, and from it 52 gr. of silver had been deposited when this series began, January 16. Five tests were made and 69 gr. of silver had been deposited from the used solution when the last test began. The result of the five closely agreeing measurements gave an increase in deposit from the old solution of 1 part in 11600.

More than two months later another series of tests on this point was made, the old solution by this time having been used a great many times, portions from it repeatedly boiled, and about 55 grams more of silver deposited from it.

The deposit from this solution was compared with that from two different 15 per cent. fresh solutions, and was greater in amount by about 1 part in 1700. Moreover, this was a percentage increase, as was proved by currents of different intensities and deposits of different amounts. But in every case in both these series of tests, the deposit from the fresh solution was more coarsely crystalline (varying from slightly to decidedly), and slightly less white in color than that from the old solution—just the opposite of what Kahle found. Furthermore, a test with litmus paper and with a litmus solution failed to show any acidity in either the fresh or "used" solutions. This again is not in agreement with Kahle's observations. But after each experiment the anodes were always more or less coated with grayish black matter, which Kahle says is coexistent with the formation of free acid in the electrolyte.

It is not impossible that the discrepancies between the results of Kahle and my own are due to the different shapes of anodes used in the two investigations. I hope to study this possibility very soon.

The silver nitrate and anodes were all obtained as c. p. from Eimer and Amend, New York.

Note on the Energy Spectrum of a Black Body. By F. A. Saunders.

In the *University Circulars* for June, 1897, and June, 1898, preliminary accounts were given of the work in progress at the time by Dr. C. E. Mendenhall and the writer on the above subject. The same work has been continued this year by the writer alone, the present object being to map out the distribution of energy in the spectrum of an absolutely black body at temperatures below 500° Centigrade, and to carry the measurements down to temperatures as near that of the room as possible. The black body was one of the same form as before, being an enclosure with walls at a uniform temperature, with a small slit cut in the walls to allow some of the radiation within to pass out to the measuring apparatus. The latter, as before, consisted of a moveable-arm spectrometer of the same form as that first used by Langley, equipped with a rock-salt prism and lens, and a bolometer whose exposed strip covered an angle of five minutes in the spectrum. The galvanometer used was also the same, one of the four-coil pattern with a resistance of 4 ohms, with all the coils connected in parallel. The distance between the coil centres was 1 inch and the waste space at the centres 3 mm. in diameter.

As the amount of radiation to be measured was very small, and as there are several lines of electric cars near the laboratory which produce disturbances in any ordinary galvanometer system, a great deal of time was spent in the attempt to make a system which would be to a high degree both sensitive and astatic. The magnets used for this purpose were made from watch hair spring, the best size being 0.05 mm. thick and 0.24 mm. wide, tempered and broken off into various lengths, from 0.5 mm. to 2.5 mm. These were mounted by means of shellac, or shoemaker's wax, on a very fine glass tube, and a fragment of silvered microscope cover-glass of an area of about 1.5 sq. m. was attached as a mirror. The weight of the entire system was from 2.5 to 3 mg. Fourteen different forms were constructed, in which the weight was kept nearly the same, but the number, length and arrangement of the magnets was varied. It was found as a result of these experiments that there was a limit with this particular galvanometer at least, both to the shortness and the thinness of the magnets, beyond which it was not profitable to go. The form finally chosen as the best was one in which each magnet set consisted of three, of lengths 1.6 mm., 2.3 mm. and 1.6 mm., the weight of the entire system being between 2.4 and 2.5 mg., and of the magnets alone 1.3 mg. With this form a current of $7.7 . 10^{-11}$ amperes produced a deflection of 1 mm. on a scale at a metre's distance, when the system had a complete period of 10 seconds.

Great difficulty was experienced in obtaining any system which would retain a long period for more than a day, whether the magnets had been boiled or not, but by making a great number of systems, and carefully adjusting their magnetic condition from day to day, one was finally obtained which held a complete period of five seconds for two weeks without alteration, and it was not possible to obtain anything better than this. The galvanometer was shielded by four cylinders of wrought iron, from ¼ to ⅜ inch in thickness, and with these precautions the system was quite steady even at high sensibilities.

The black body was a double-walled vessel of sheet copper, the interspace of which could be filled with liquids whose boiling points gave the desired temperatures. Its dimensions were: outside diameter 13.7 cms., outside height 17.5 cms., inside diameter 7.5 cms., and inside height 11.2 cms. The slit was 3 cms. by 0.6 cms., its area being about $\frac{1}{90}$ of the total internal area of the black body. In order to reach the higher temperatures obtained, the vessel was enclosed in an asbestos furnace, and its bottom was shielded by fire-clay from direct contact with the flames. By arranging these so that they nearly enclosed the entire vessel, and leaving the inter-space empty, a fairly uniform temperature was obtained in the interior.

Energy curves were taken at the following temperatures:—578°, 503°, 399°, 313°, 243°, 175° and 100° Centigrade, and from their form, though the final corrections have not yet been applied to them, it is evident that they furnish, at least approximately, a confirmation of the formula for the distribution of energy deduced theoretically by Wien and experimentally by Paschen. The drawing of the true curves is, however, as before, made very uncertain by a great number of absorption bands, which were always present, although special precautions were taken to have the air about the spectrometer as dry and as free from carbon dioxide as possible.

It was intended to obtain a curve also for the temperature of –183° Centigrade, given by the boiling of liquid air, but unexpected difficulties were encountered in obtaining any of this fluid, and it was not possible to carry out this extension. A small amount was, however, procured through the kindness of Prof. William Simon of the Maryland College of Pharmacy, but it evaporated completely as soon as it was placed in the black body and failed to reduce its temperature lower than –90° C. At this point a small deflection was obtained, of about the amount expected from the formula, at at a wave-length of 10 μ, which is where the maximum energy at this temperature should fall if the product of the absolute temperature and the wave-length of the maximum of the energy-curve is a constant quantity—as follows from Paschen's formula. It is interesting to note that if the formula holds down to –183° C., the maximum of the curve will be found at about 30 μ, and will therefore be beyond the reach of any rock-salt dispersion apparatus.

On the Absorption of Ice in the Ultra-red. By F. [illegible] Saunders.

The object of this experiment was to determine the absorption of ice and to compare it closely with that of water, using the same amounts of both in the attempt to find whether the change in physical state produced any change in the absorption.

The spectro-bolometer used is described in the previous note; but the source of radiation was a blackened platinum strip electrically heated. This was placed 8 centimetres from the optical slit of the spectrometer, and at a distance of 2 centimetres there was an arrangement by which a cell containing water could be interposed in the path of the radiation. This cell consisted of a small frame cut out of sheet brass, surrounding a hole 1.2 × 3 centimetres, over which thin pieces of mica were fastened on both sides, enclosing between them a space as thick as the brass frame itself. This was set in a slide so that it could be dropped to the bottom of a narrow empty tin tube, 20 cms. in length, which could be completely surrounded by a freezing mixture when desired. Two cells were used, of 0.8 and 0.25 mm. thickness.

The absorption of the mica sides alone was first measured; then that of the cell filled with water, and finally this was dropped into the cold air in the tin tube and frozen. It was then interposed in the path of the radiation only for the instant required to measure its absorption, and at once dropped back into the cold air. It was only with this arrangement that it could be kept frozen as long as was necessary.

$L\equiv$ inductance of fixed coils of electro dynamometer.
$l\equiv$ inductance of hanging coils of electro-dynamometer.
$C\equiv$ capacity of condenser.

Now, the condition that the currents in arm 1 and in the cross connection differ in phase by 90°, or that there is no deflection of the electro-dynamometer, is that

$$R_1=\frac{R_2 R_4}{R_3}+\left(\frac{l}{C}-b^2lL\right)\frac{R_3+R_4}{R_4\,(R_2+R_3)+r\,(R_3+R_4)}$$

The term involving b^2lL is very small, so that it may be thrown out.

R_1 calculated according to the above formula, will include both the actual ohmic resistance and the resistance due to the electric absorption. If the resistance of the arm 1 be measured and subtracted from R_1 the remainder is evidently the resistance due to the electric absorption.

A few measurements were first made, using ordinary parafine paper condensers, but the heating by the current was so great that no conclusions could be drawn from the measurements, since the absorption resistance varies greatly with temperature.

A condenser was then used which had been made in a vacuum. This showed scarcely any heating by the current, so that during several hours work in a room fairly constant in temperature, the electric absorption showed quite small variation. The condenser was one of eight microfarads capacity. The resistance due to electric absorption of four microfarads was 2.56 ohms, that of the other four 2.44. From these the resistance of the eight M. F. in parallel should be 1.25. The value found was 1.28.

The relation between the period of the current and the resistance of electric absorption was now studied. The period was determined accurately by means of a speed counter and chronograph; by this means the speed could be determined as closely as the constancy of speed would permit. Several series of observations were taken with the period varying from 6 or 8 to 133 per second. In all the observations taken within a few hours the temperature was assumed constant, as it would be very nearly, since there was very little heating; and any change of temperature in the room would penetrate into the condenser very slowly, as they were tightly enclosed in wooden boxes.

The following table shows the nature of the variation of the resistance due to electric absorption with the period of the current.

$N\equiv$ *number of alternations per second.*	$A\equiv$ *electric absorption resistance.*	$N\times A$
13.02	14.79	192.6
27.46	7.06	193.9
26.98	7.12	190.5
130.46	1.58	206.1
22.98	8.60	198.3
17.94	9.99	179.2
7.75	23.19	179.7
13.91	13.07	181.8
16.89	10.73	181.2
33.25	5.46	181.5

The column $N\times A$ is nearly constant throughout. This was found to be true in all the observations, with slight variations. These being easily accounted for by changes in the temperature, and in the case of the higher periods by the fact that the quantity to be found, A, is the difference between two nearly equal quantities. The above table also shows the sensitiveness of the electric absorption A to temperature changes. The first five observations were taken on one day and the others on another. The change of temperature was but a few degrees.

A series of observations were taken keeping the period nearly constant and varying R_3 from 2000 to 100 ohms and R_4 from 100 to 2000 ohms.

The following table shows the result:

R_3	R_4	N	A	$N\times A$
509.2	507.2	15.61	11.84	184.8
2071.	99.56	17.92	10.20	182.8
99.46	2044.5	18.45	10.09	186.2

The above results show that the quantity A depends in no way o resistances in the arms of the bridge.

Another series of observations were taken, in which the period was constant, and the e. m. f. acting on the condenser varied.

The following table shows the results:

$V\equiv$volts e. m. f. acting on condenser.	N	A	$N\times A$
243	17.18	11.87	203.9
76	17.95	11.72	198.7
142	19.43	10.21	198.4

This table shows the resistance due to electric absorption to be pendent of the e. m. f. acting on the condenser.

It appears from the above, then, that a condenser having electric a tion may be considered as a capacity in series with a certain resis This resistance is a function of the temperature of the dielectric, b of the e. m. f. acting on the condenser. It is also a function of the of the current passing through the condenser. It varies, at least i condenser used in this investigation, inversely as the number of altern of the current.

Transference of Heat in Cooled Metals. By (KINSLEY.

Several observers at different times and in different countries[1] noticed an immediate rise of temperature at the cooler end of a metal when the hot end was suddenly cooled.

Since this would be a most astonishing effect, an investigation o matter was undertaken and carried out as follows.

Iron and steel bars of about one-half inch diameter were used, and copper thermo-electric couples were soldered to the cooler end of th and to its side. A reflecting galvanometer was used that gave a defl of 1 mm. per 0°.05 C. change in temperature. The end of the ba heated by a Bunsen compound burner or in a muffle furnace with a lamp. The hot end of the bar was cooled either with blocks of ice pouring ice water upon it. The most severe conditions imposed b above experimenters are thus fully equaled.

After errors, due to jarring the galvanometer, and to changes i magnetic field of the galvanometer, caused by motion of the bar, had eliminated, no effect was observed, even under the most trying condi The temperature of the cooler portion of the bar did not increase whe hot end was suddenly quenched. The most severe test imposed inc the sudden quenching in ice water of the end of the bar, three incl which were above the red heat. The thermo-couple then was only inches from the glowing end of the bar.

The galvanometer, of course, showed the usual slow change of tem ture due to conduction. There was, therefore, a comparatively long time quenching before any change of temperature was indicated, and the change was only a reduction of temperature.

A Method of Measuring the Frequency of Al nating Currents.[2] By CARL KINSLEY.

When an electro-magnet is energized by an alternating current i produce an alternating magnetic field. If a strip of iron, whose n period is the same as or twice that of the alternating current, is r held near the magnet, it will be set in vibration. Such a rod can be to measure different frequencies by changing it in such a way as to m vibrate synchronously with the magnetic field. The common freq can then be computed from the physical constants of the bar. This change of the frequency of the bar is most easily accomplished by varying its moment of inertia by means of a non-magnetic rider.

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[1] M. Henry Bourget, "Astronome adjoint à l'observatoire de Toulouse, juin 14," June 30, 1898.

Mr. A. T. Bartlett, Cavendish Laboratory, Cambridge, 1889, *Nature*, Sept. 1, 189

Mr. J. S. Stone, Johns Hopkins University, Baltimore, Md., 1888, *Nature*, Oct. 2

[2] A more detailed description of this method will be found in the *Physical* April, 1899. A description of other methods that are used for this purpose is a appear in the *Electrician* (London).

The frequency is the reciprocal of the time of one complete period (t). This time can be computed in the case of any iron or steel rod from the following equation:

$$t^2 = 1.17 \times 10^{-10} \frac{mr^3}{h\tau^3} + 2.13 \times 10^{-10} \frac{l^4}{\tau^2} \quad (1)$$

m = mass, in grams, of the rider. r = distance, in centimetres, of the rider from the supported end of the "clamped-free" bar. h = width, τ = thickness, and l = length of the bar from its support, in centimetres.

If a bar has $h = 1$ cm., $\tau = 0.056$ cm., $l = 7.7$ cm., and $m = 0.27$ g., then the equation becomes

$$t^2 = 1.80 \times 10^{-7}\, r^3 + 2.39 \times 10^{-4} \quad (2)$$

In practice a curve determined from this equation will be found a convenient method of quick computation. This rod can be used to measure frequencies between 64.7 and 56.1 periods per sec. The determination can be made with an error of less than ¼ of 1 per cent.

A good many kinds of iron and steel bars were tested, and the periodicity was found from autographic chronographic records. Equation (1) can be used with band iron or mild steel with an error of less than 19 per cent., but if very accurate absolute determinations are wished, it will be necessary to find the constants in the case of the rod being used.

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PROCEEDINGS OF SOCIETIES.

Scientific Association.

April 27, 1899.—One hundred and forty-fifth regular meeting. The President of the Association in the chair.

Paper read:
A Description of a New Form of Multiplex Printing Telegraph, by Henry A. Rowland.

Philological Association.

March 17, 1899.—One hundred and seventy-third regular meeting. Professor Gildersleeve in the chair. Thirty-seven members were present.

Papers read:
The Legenda Aurea and its French and English Translations, by P. Butler.
The Transformations of a Legend, by W. H. Browne.

April 21.—One hundred and seventy-fourth regular meeting. Professor Gildersleeve in the chair. Thirty-two members were present.

Papers read:
Archaeological Aspects of the Mosaic Sanitary Legislation, by P. Haupt.
The Perlesvaus Romance and the "Manessier" Continuation of Crestien's Perceval, by W. A. Nitze.

May 19.—One hundred and seventy-fifth regular meeting. Professor Gildersleeve in the chair. Twenty-seven members were present.

Papers read:
The Versification of King Horn, by H. S. West.
Synecphonesis in Early Spanish Poetry, by C. C. Marden.

Historical and Political Science Association.

March 17.
History of Street Railway Legislation in Baltimore, by J. H. Hollander.
Leslie Stephen's Studies of a Biographer, by Robert Garrett.
Dixon's History of the Missouri Compromise and its Repeal, by St. G. L. Sioussat.
A Study of Gothic Architecture, by J. M. Vincent.

April 7.
The Church and Education, by H. B. Adams.
The Provincial Governor in the English Colonies, by D. E. Motley.
Muirhead's Land of Contrasts, by W. E. Martin.
Lebon's Modern France, by V. A. Renouf.
Watson's Story of France, by E. T. Dickerson.
Walker's Discussions in Education, by C. W. Sommerville.

April 21.
The Diplomacy of the Confederacy, by J. M. Callahan.
Fisher's Mediaeval Empire, by P. L. Groome.
Bishop's Corea and Her Neighbors, by J. C. Tyler.
Ladd's Higher Education, by A. T. Freeman.
Sidney Lee's Life of William Shakespeare, by O. J. Marston.
Ford's American Cruiser in the Far East, by W. S. Drewry.
Strobel's Spanish Revolution, by W. W. Brander.

May 5.
A Study of Homeless Men, by B. W. Arnold.
University Extension in Scotland, by H. B. Adams.
Bemis on Municipal Monopolies, by C. E. Persinger.
Church's Oliver Cromwell, by W. J. Boggs.
Fiske's West Indies, by G. L. P. Radcliffe.
Rogers' Men and Movements in the English Church, by W. E. Martin.
Richmond's Friendly Visiting Among the Poor, by Robert Garrett.
Belloc's Danton, by W. S. Myers.
Impressions of European University, by A. F. Lewis.

May 19.
Religious Freedom in Virginia, by W. T. Thom.
Chamberlain's John Adams, by C. E. Persinger.
King's De Soto, by W. S. Drewry.
Bennett's Downfall of the Dervishes, by W. S. Myers.
Peck's Jacksonian Epoch, by O. J. Marston.
McCall's Thaddeus Stevens, by C. C. Weaver.

colonial records need only be consulted to substantiate this fact. While the negro slave had the disadvantages incident to his color, the indented white servant was at a disadvantage in many respects greater as to maintenance and protection. The negro was regarded as a mere tool in the hands of the more intelligent servant, and for this reason he excited a sympathy which bettered his condition and rendered it in every respect superior to the European peasant. The negro was a protégé of the colony, to be educated for the purpose of civilizing his fellow beings of the dark continent. This was the period when England declared that the slave trade was most beneficial and not to be restrained. Her policy was to rivet slavery upon the North American continent in order to destroy manufacture and encourage agriculture. Masters were employed to restrain the slaves, and slaves were in turn aroused to rebellion to suppress the opposition of the whites to the schemes of the mother country. Notwithstanding this policy, Virginia recognized the free negro as a citizen with most of the rights of his white brother. At the first meeting of the legislature of the Commonwealth in 1777 an act was passed prohibiting the enlistment of only those negroes and mulattoes who had no certificate of freedom. Many of these enlisted in the service of the colony and their services were recognized by the State legislature. The insurrectionary attempts of this period were local and few in number.

For fifty years no signs of rebellion appeared. After 1668, there are four other attempts, if the murder of a master and his family can be termed an insurrectionary attempt. The first forty-seven years of the Commonwealth of Virginia are characterized by the same vehement opposition to slavery. In 1783, there was passed "An Act concerning the emancipation of certain slaves who had served as soldiers in this State." This was a step in advance of the Act of 1778, which prohibited the further importation of slaves into the Commonwealth. England had changed her policy and a strong abolition sentiment arose in the absence of an economic interest in the institution of slavery. This moral sentiment was carried so far that she deemed herself justifiable in violating international law, which was rendered possible only through the natural and reasonable sentimental sympathy aroused in those sections of the United States, furthest removed from the dangers of servile discontent. It was not, as many historians would lead us to believe, that Virginia's policy changed. She still strove to rid herself of the negro, but was unfortunate in being forced into a position which at first sight would appear to her discredit. The idleness and dissipation acquired in the camps of the French and English exhibited themselves in the negroes of this period. English spies were arrested in attempts at arousing the slaves to rebellion, and when English efforts were slackened, French influence took its place. The refugees from the St. Domingo Massacre of 1793 arrived in the United States. Many of their slaves had followed them voluntarily, but the majority were forced aboard the vessels and brought to Virginia. Their immediate influence was seen in the various attempts at revolt in all Eastern Virginia and Carolina. From 1792 to 1812 occurred three-fourths of the slave revolts in the history of the State.

The Gabriel Insurrection, which took place in Richmond in August, 1800, is the central fact of this period, and was the first servile attempt of any importance. More than one thousand slaves were implicated. Between 1814 and 1830, there was comparative quiet, and only one alarm was occasioned by the slaves. The convention for revising the constitution of the State met in 1829. The slaves were informed by some suspicious persons that it was called for the purpose of emancipating them. Consequently, they determined to murder all the whites in case of a failure.

The French influence had not been extinguished in 1831, the beginning of the third period of our study. It was seen in the Southampton Rebellion of August, 1831, which is given by most histories as the second and last rebellion of the slaves of Virginia. This rebellion and the alarm of 1829 together with the presence of great numbers of abolition missionaries tended to arouse a spirit of opposition to emancipation. In 1833, the slaves of the British West Indies were freed. The South American States had previous to this followed the same course. Thus there were three great bodies of free negroes ever threatening the slave States. The danger from this direction together with that from the Creek, Cherokee and Seminole Indians was the cause of much slavery legislation, which because of its frequency has been characterized as most stringent and cruel, but which to the careful student resolves itself into a series of acts for the prevention of slave rebellion and the spread of insurrectionary doctrines from Indians, unscrupulous whites, French and British. The l
rectionary attempt was the John Brown Raid.

In all, there were about fifteen slave revolts in Virginia, all
were local and included those cases in which only a few sl
implicated. The characteristic feature of each is that at the bo
was white or Indian influence, which played upon the cred
superstition of the negro and used as a tool some fanatic, who wa
ready to undertake the task of freeing his race. Each plot was
by means of some faithful slave who of his own will reported
master and led his fellow servants to stand loyally by the whites.
of one hundred people were slaughtered by insurgent slaves in
and the history of slave insurrection but serves to emphasize the
humane and kind treatment of the negro and portrays in the an
slave a true nobleness and heroic manhood, worthy of the Christ
From 1829 to 1865 not more than thirty slaves were guilty
rebellion and conspiracy. During the War when rare opportu
murder, rapine, and insurrection were offered, a loyalty was sho
slaves unsurpassed for the devotion of dependents to their superic

INTERNAL IMPROVEMENTS IN NORTH CARO

[Abstract of a paper read by CHAS. C. WEAVER to the Southern History
February 17, 1899.]

Agitation over the question of internal improvements began in
degree in North Carolina just after the close of our second war w
Britain. Numerous schemes had been presented before this
considerable work had been done, but the period of greatest ac
from this time on. Agitation was soon intense. Conventions we
resolutions adopted and addresses presented by leading citizens, al
the necessity of opening up routes of trade both into and thr
State. The improvement of transportation facilities as the a
commerce received chief attention.

In the movement for internal improvements was involved m
than at first appears. It was political as well as economic. At
the most intense jealousy and rivalry existed between the differen
of the State. Under the constitution of the State certain count
east were entitled to more than one representative in the legisla
the west was being rapidly settled, the matter of inequality of repr
in comparison with the population of the two sections became a se
The west stood for unrestricted suffrage and equal representation,
east was content to leave undisturbed the system which insure
political supremacy. This jealousy entered into all considera
internal improvements. Each section was determined that t
should not receive more than its share of attention on the pa
State. In trying to steer between the factions and to please both
dissipated its resources and brought to naught much work th
have had good results if it had been rightly applied in any one
but scattered as it was, the state money could do but little good.

It will be unnecessary to follow all the various schemes t
planned at different times. A general outline of the whole
improvements may be gotten from the following brief summary.

Improvements related, first, to inlets and sounds on the coast.
former the two that attracted considerable attention were the C
and the Cape Fear. The central position of the latter made it p
important, while the commerce of the Tar, Neuse and Roanoke
to be dependent on the Ocracocke. Difficulties in the way of these
attention to the inlet at the end of Albemarle Sound.

The very first attempt that was made at improvements was
toward rendering the rivers navigable. In addition to those m
the Cape Fear, the Yadkin, the Catawba and the Broad all rece
attention of the Legislature. The plans included not only mak
navigable, but also connecting them by canals. Then, too, road
constructed in places where there were no rivers. Thus it is seen
middle of the State was to be satisfied by the improvements of t
the west by the building of roads and the east must also be help
draining of the swamps and marshes of the eastern and souther
the State. It was claimed to be a matter of moment for the nation
coast should be made accessible and demands were made upon th
States government for the State's share in federal surveys and impro

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PROFESSOR SIMON NEWCOMB.

[Reprinted from *Nature*, London, May 4, 1899. The following sketch is by Professor MAURICE LOEWY of Paris, Director of the Paris Observatory, President of the Bureau des Longitudes, Paris, and Member of the Academy of Sciences, Paris.]

Newcomb must be considered, without contradiction, as one of the most celebrated astronomers of our time, both on account of the immensity of his work and the unity of view which marks the choice of the subjects treated by him.

All is linked together in our solar system: the study of the motion of each one of the celestial bodies forming part of it is based upon the knowledge of a great number of numerical data, and there exists no fundamental element whose influence is not repercussed on the entire theory of these bodies. To endeavor to build up the theory of our whole planetary world on an absolutely homogeneous basis of constants was an almost superhuman task.

The evaluation of each one of these data demands, indeed, that one should attentively go over most of the previous researches, and continue them by more thorough methods. All Newcomb's work, followed up with rare perseverance, has constantly tended to this ideal end: first to arrive at a more exact knowledge of the magnitudes serving as points of reference, and then to establish the theory, not only of all the planets, but also of their satellites on a system of constants as precise as modern observations permit. Wishing to realize in a complete manner this vast programme, Newcomb has recognized that the published observations do not always furnish the necessary information for obtaining with exactness all the looked-for elements. Abandoning, therefore, the domain of pure speculation, he has given himself up to researches which proclaim him possessed of a talent of observation of the highest order. By personal studies he has succeeded in filling many of the gaps which seriously impeded the progress of theory. Thus, in order to determine the masses of Neptune and Uranus and the elements of their satellites, he made a series of observations of great value, on which are partially founded the ephemerides inserted in all nautical almanacs.

I shall simply mention here in a few words some of the preparatory work preceding the construction of the magnificent edifice of which I have indicated the plan, on the happy completion of which the scientific world is to be congratulated. Throughout its execution one recognizes the sign of a master-mind whose conclusions assume a definite character and remain acquired to science.

The solar parallax is one of the most essential data which intervene in all researches concerning the planetary system. Newcomb undertook to fix its value by the discussion of all the transits of Venus observed previously to 1882. In a very detailed memoir, he calls astronomers' attention to the danger to which they are exposed by giving an exaggerated confidence to certain modern methods. The systematic exclusion of the ancient observations cannot sufficiently be justified by discordances which exist between their results and those obtained more recently. By a minute and impartial discussion of all existing documents, Newcomb arrived at a value almost identical with the one adopted in 1896 by the International Conference of Paris.

Again, in order to obtain by an altogether independent means the value of this same constant, Newcomb undertook a determination of the velocity of light, based on the ingenious method suggested by Léon Foucault. These researches of a physical nature opened the way to an important advance in our knowledge of the heavens. In fact, we had all reason to hope that the value obtained for the velocity of light, combined with the constant of aberration, would allow us to determine the solar parallax more accurately than by the usual astronomical methods. Newcomb holds that multiplicity of methods is an essential condition of success; this motive led him to choose Foucault's method, which he applied with rare sagacity. The agreement between the different results obtained in this way by Cornu, Michelson and Newcomb is an admirable one, and testifies to the knowledge and skill of the experimenters. With the help of the values found for the velocity of light, it would have been possible to deduce the parallax, if [illegible] observations had not revealed the uncertainty which still hovers [illegible]al value of the aberration constants.

I cannot close the list of these preparatory studies without referring to [illegible] subject which interests the highest problems of astronomy of precision.

The observations of the planets and of the moon depend on the coordinates of the fundamental stars, of which unfortunately we possess [illegible] yet no catalogue absolutely free from systematic errors. One of Newcomb's constant preoccupations was to try to constitute a uniform system of points of reference, at least in right ascension, this coordinate having weight [illegible] importance in the case of observations of moving bodies. The catalogues drawn up by him, and by Auwers, for the fundamental and bright stars of the ecliptic, have shared in equal measure up to a very recent date the favo[illegible] of astronomers. But the use, in the same scientific research, of elements derived from different sources, presents inconveniences acknowledged for a long time. A reform in this direction had become very desirable. This circumstance has again afforded Newcomb the opportunity of manifesting the inexhaustible resources of his activity and talent. An international conference, held in Paris in 1896, under the auspices of the Bureau des Longitudes, had as its object to elaborate a common system of constants and fundamental stars to be employed in the astronomical ephemerides. Newcomb took one of the most important parts in the discussions and resolutions of this conference. At its suggestion he has undertaken, not only the research of the definite values to adopt for the lunar-solar precession and the planetary precession, but also the construction of a new catalogue of fundamental stars in accordance with the system of elements chosen by the Paris meeting of astronomers. Newcomb has consecrated these two later years to the accomplishing of this arduous task. The catalogue of fundamental stars, which he has just finished, will come into use in the beginning of 1901, and will realize in the work of astronomers that unity and simplification so long desired.

I now come to the labors which have absorbed the greatest part of Newcomb's scientific activity: they refer to the domain of celestial mechanics.

At the time when the great work of Le Verrier had only reached the tables of Jupiter, Newcomb published an excellent theory of the two planets furthest from us, Uranus and Neptune. These tables, from the moment of their appearance, have been used by astronomers of every country.

Among the greatest triumphs of Newcomb's career must be counted his many and fruitful researches on the motion of the moon. The theory of the moon bristles with difficulties. No one has yet succeeded in establishing a complete harmony between theory and observation. In his lunar tables, Hansen, in order to obtain this accordance for a limited interval of time, was obliged to attribute to an inequality arising from the action of Venus an empirical coefficient of an excessive amount, and to adopt besides an acceleration of the secular movement twice as great as that which results from the law of universal gravitation according to the calculations of two illustrious geometricians, Adams and Delaunay. Should we, as a great number of *savants* think, attribute to Hansen's number, so far from the theoretical value, an indisputable reality, and try to discover the physical causes of the anomaly; or should we see the origin of the disagreement in an erroneous interpretation of historical documents? Newcomb did not recoil before the difficulties which the solution of this problem entailed. He discussed all the occultations observed since the invention of the telescope up to a recent time; he himself examined forgotten observations, buried for one hundred and fifty years in the registers of the Paris Observatory. These neglected documents have thrown a vivid light on the question. In thus utilizing an abundant harvest of new information, and correcting Hansen's theory by the exclusion of every empirical coefficient, Newcomb arrived at results of fundamental importance. He proved, agreeing in this with Tisserand's researches, that the eclipses of the Almagest and those of the Arabs, as well as the ancient occultations, agree very well with the theoretical value of the secular acceleration; and further, as a corollary, that the most ancient solar eclipses, the representation of which would seem to demand an increase of the secular acceleration, can without scruple be left out of consideration, either because the reality of the phenomenon remains doubtful, or because there exists too great an uncertainty in the hour and place of observation.

One might without inconvenience, therefore, adopt the theoretical acceleration of $6''$, correcting the mean motion and the longitude of the epoch. But whatever value is chosen, and this was not anticipated, one must, after having suppressed Hansen's erroneous inequality, resign oneself to introduce another notable empiric term of a period of about two hundred and seventy years, and of an unexplained origin; one simply notes that this amplitude is nearly that of an inequality due to Venus, the existence of which is not doubtful.

Besides this empiric inequality, Newcomb has discovered another, less pronounced, with a coefficient superior to 1″, with an amplitude of about twenty-seven days, and appearing to be associated with a long period perturbation of the excentricity and perigee. These delicate deductions have since been confirmed by the theoretical researches of Messrs. Neison and Hill, which show that the terms in question are due to the action of Jupiter. By all these investigations, Newcomb has elucidated, in a masterly way, the actual state of the theory of the motion of our satellite.

The two theories of the moon which must be considered the best are those of the two celebrated geometricians, Delaunay and Hansen; they are founded on totally different methods. By the help of a long, minute and tedious transformation, because it is a question of formulæ occupying several quarto volumes, Newcomb has rendered their expressions immediately comparable, bringing them moreover to a system of precise and uniform constants.

Further, by this comparison, he has shown that, in spite of the difference of method, the two theories lead to identical results for solar perturbations, which form the essential part of them and are indeed the only ones which were calculated by Delaunay.

I must now pass very briefly to some of Newcomb's other memoirs. One of his most original researches is relative to Hyperion, Saturn's seventh satellite, discovered almost simultaneously by Bond and Lassell. The movement observed was in disaccord with the prediction of theory. In fact the major axis of Hyperion's orbit, instead of moving, directly, round Saturn in a century, accomplished a revolution in the opposite direction in the short period of eighteen years.

Newcomb has proved that this rapid retrograde revolution is caused by the perturbing action of the next satellite Titan.

In the various volumes of "The Astronomical Papers for the use of the American Nautical Almanac," Newcomb has published a great number of memoirs. One can follow step by step the immense progress achieved in the execution of the vast project which he had taken upon himself to accomplish.

It is difficult to convey an idea of the considerable efforts, the sagacity which must be displayed, the numerous investigations which must be accomplished, in order to make known to a sufficient degree of approximation the motion during a century of a body of our planetary system. Only those scientific men who have given themselves up to analogous studies can appreciate the enormous expenditure of physical and intellectual energy which must have been necessary to Newcomb in order to bring to a happy end the researches on the four planets nearest the sun. Newcomb has based his work on more than 60,000 observations, which he has compared with Le Verrier's tables; the perturbations have been calculated with great precision. While Newcomb has thus founded theories of these planets on a more precise basis, his celebrated collaborator, Mr. Hill, has obtained the same results for the two planets Jupiter and Saturn.

Henceforth, science will profit by the fruits of this immense labor, consisting of the tables of the planets Mercury, Venus, Mars and the Earth. In a special volume there are to be found various researches on the fundamental constants of astronomy.

We have only been able to give a short sketch of Newcomb's achievements; he is gifted with a prodigious power of work, which is testified by the extraordinarily long list of his researches.

The reception which has been accorded to them by all competent men points to their author as one of the most illustrious representatives of celestial mechanics.

This activity has embraced the most diverse branches of astronomy. Not only has he given a great scope to the intellectual movement of his country, but he has also contributed in a very successful manner to elevate the level of the civilization of our age, enriching the domain of science with beautiful and durable conquests.

LOEWY.

PRESENTATION OF A PORTRAIT OF PROFESSOR REMSEN.

In December 1897, a circular letter was sent to Professor Remsen's former students, requesting their aid to secure his portrait for the University. The response was so prompt and hearty that the committee was enabled, before the summer vacation, to present the project to Professor Remsen and to request him to sit for the portrait which was painted, during the summer, by Mr. Robert Gordon Hardie at Brattleboro, Vermont, where Professor Remsen very kindly consented to spend part of the vacation and thus secure a portrait painted under the most favorable circumstances. The portrait represents him in a sitting position with one arm resting on the arm of a chair. It is an excellent likeness and a fine work of art and will be as great an accession to the University collection as that of Professor Newcomb, which was painted by the same artist. Besides the former and present students, some of Professor Remsen's colleagues and personal friends assisted in securing the portrait. It was formally presented at the public Commemoration exercises on February 22, by Dr. J. Elliott Gilpin, who had acted as secretary of the committee, and was accepted, on behalf of the University, by Mr. C. Morton Stewart, President of the Board of Trustees. In presenting the portrait to the University Dr. Gilpin said: "I have the pleasure of presenting to the University, on behalf of the former and present students and some of the associates and friends of Professor Remsen, his portrait which was painted last summer at Brattleboro, Vermont, by Mr. Robert Gordon Hardie. In doing so I cannot refrain from expressing, in their behalf, their appreciation of the great benefits they have derived from their intercourse with Professor Remsen as an instructor and a friend. They have been inspired and encouraged by the example of his enthusiasm and have gone out to their life work with high aims and ideals. These men are now exerting their influence for the advancement of their profession and the welfare of the nation, and are distributed over more than 30 states from Maine to California and from Minnesota to Louisiana. As for his work in behalf of the University and this city, no words of mine are necessary to you who know so well the part he has played in the growth of this institution and in all matters concerning the welfare of the city. It is then as a slight token of our appreciation of his services in our behalf that we present this portrait to be hung on these walls with the portraits of those whose labors and noble deeds in behalf of this University will ever be recalled by these portraits. In this paper will be found the names of those for whom I now present this portrait to the University."

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Associate in German.

James C. Ballagh, Ph. D.,
Associate in History.

Abraham Cohen, Ph. D.,
Associate in Mathematics.

J. Elliott Gilpin, Ph. D.,
Associate in Chemistry.

Harry C. Jones, Ph. D.,
Associate in Physical Chemistry.

George C. Keidel, Ph. D.,
Associate in Romance Languages.

Edward C. Armstrong, Ph. D.,
Associate in Romance Languages.

Charles R. Bardeen, M. D.,
Associate in Anatomy.

Harvey W. Cushing, M. D.,
Associate in Surgery.

George W. Dobbin, M. D.,
Associate in Obstetrics.

N. Ernest Dorsey, Ph. D.,
Associate in Physics.

Duncan S. Johnson, Ph. D.,
Associate in Botany.

Walter Jones, Ph. D.,
Associate in Physiological Chemistry and
Toxicology.

Philip Ogden, Ph. D.,
Associate in Romance Languages.

George B. Shattuck, Ph. D.,
Associate in Physiographic Geology.

S. Edwin Whiteman,
Instructor in Drawing.

Harry L. Wilson, Ph. D.,
Instructor in Latin.

Frank R. Smith, M. D.,
Instructor in Medicine.

H. Barton Jacobs, M. D.,
Instructor in Medicine.

Oliver L. Fassig, Ph. D.,
Instructor in Meteorology.

Otto G. Ramsey, M. D.,
Instructor in Gynecology.

Guy Carleton Lee, Ph. D.
Instructor in History.

John B. Whitehead, Jr., A.
Instructor in Physics.

Hugh H. Young, M. D.
Instructor in Genito-Urinary D

Murray P. Brush, Ph.
Instructor in Romance Lang

Morris C. Sutphen, Ph
Instructor in Latin

In addition, there are a numbe
the laboratories.

PROGRAMMES FOR 1899-1900.

The following courses in literature and science are offered for the academic year which begins October 1, 1899. They are open to roperly qualified young men, according to conditions varying somewhat in each department.

MATHEMATICS.

Advanced Courses.

Professor Craig.

The general Theory of Abelian Integrals and the Inversion Theory.
Three times weekly, first half-year.

Automorphic Functions.
Three times weekly, second half-year.

General Theory of Differential Equations.
Three times weekly, through the year.

Chapters in the Theory of Surfaces.
To be given occasionally.]

Dr. Cohen.

ementary Theory of Functions.
Twice weekly, through the year.

gher Plane Curves.
Twice weekly, through the year.

e's Theory of Transformation Groups.
Twice weekly, first half-year.

vanced Algebra.
Twice weekly, second half-year.

Undergraduate Courses.

Major Course.

terminants.
Four hours weekly, until October 20. Professor Hulburt.

fferential and Integral Calculus (special topics).
Four hours weekly, October 24 *to December* 22. Professor Hulburt.

ements of Projective Geometry.
Four hours weekly, January 2 *to Februury* 23. Professor Hulburt.

alytic Geometry of Three Dimensions.
Four hours weekly, February 27 *to April* 11. Professor Hulburt.

ementary Theory of Equations.
Four hours weekly, April 18 *to the end of the year.* Professor Hulburt.

Minor Course.

alytic Geometry.
Four hours weekly, until December 21. Professor Hulburt.

ifferential and Integral Calculus.
Four hours weekly, January 2 *to the end of the year.* Professor Hulburt.

For Candidates for Matriculation.

lgebra (special topics); Solid Geometry; Plane Trigonometry; Analytic Geometry (straight line and loci).
Four hours weekly, through the year. Dr. Cohen.

Elective Course.

ifferential Equations.
Two hours weekly, through the year. Dr. Cohen.

This course presents the elementary principles of Ordinary and Partial ifferential Equations, and affords to students of Physics, Astronomy, and lectricity a necessary working knowledge of the subject. Much time is voted to the solution of problems.

PHYSICS.

[A more detailed programme has been separately issued and may be had on application.]

Advanced Courses.

Professor Rowland will lecture on—

Heat Conduction and Physical Optics.
Four hours weekly, through the year.

These lectures constitute one-half of a complete course, which extends through two years. In the year 1900–1901, the lectures will be on Electricity and Magnetism.

Professor Ames will direct the *Physical Seminary*, which meets once a week through the year, and to which only the most advanced students are admitted. During the first-half of the year, the subject of Thermodynamics will be considered in the Seminary; and that of Spectrum Analysis, during the second.

Professor Ames will also lecture on—

Theoretical Mechanics.
Two hours weekly, first half-year.

Hydrodynamics and Sound.
Two hours weekly, second half-year.

These lectures are designed to be introductory to Professor Rowland's course, and students should take them during their first graduate year.

For all the advanced lectures a thorough knowledge of analytic geometry of three dimensions and of differential equations is necessary.

Dr. Dorsey will hold recitations and conferences on the above lectures.
Twice a week, through the year.

Dr. Dorsey will also direct the work in the astronomical observatory.

Mr. Whitehead will lecture on—

Special Topics in Applied Electricity.
Two hours weekly, through the year.

This course will be accompanied by tests and laboratory experiments.

Dr. L. A. Bauer will give a special course of lectures on The Magnetism of the Earth.

For courses in Geological Physics and in Physical Chemistry, the programmes in Geology and in Chemistry may be consulted.

Laboratory Work.

Advanced students are expected to give as much of their time as possible to laboratory work. This consists at first in performing experiments which are designed to familiarize them with laboratory methods and with the use of instruments for exact measurements. When sufficient experience of this kind has been acquired, they undertake, under the guidance of the instructors, some research designed to be of permanent value.

Journal Meetings.

The instructors meet once a week with the advanced students for the reading and discussion of the current physical journals.

Among the journals on which reports are regularly given are the following: The Philosophical Magazine, The American Journal of Science, The Physical Review, The Astrophysical Journal, Wiedemann's Annalen and Beiblätter, Zeitschrift für physikalische Chemie, Journal de Physique, Annales de Chimie et de Physique, Nature, Comptes Rendus, London Electrician, the Proceedings of the Royal Society of London and of many other societies.

Collegiate Courses.

These courses are designed for undergraduates and for those graduate students who wish to extend their knowledge of Physics, but are not prepared for more advanced work.

First Year (Minor Course.)

1. Lectures and recitations on General Physics.

Four hours weekly, through the year. Professor Ames.

2. Laboratory Work.

Three hours weekly, through the year. Dr. Bliss and assistants.

This course does not assume that the student has had any previous acquaintance with physics; but he is supposed to know how to use logarithms and to have had thorough instruction in plane trigonometry.

Second Year (Major Course.)

1. Lectures and recitations on the following subjects:

Mechanics, including some simple problems in the motion of rigid and elastic bodies.
Elementary Thermodynamics.
Electricity and Magnetism.
Physical Optics.
Four hours weekly, through the year. Professor Ames.

2. Laboratory Work.

Five hours weekly, through the year. Professor Ames and Dr. Bliss.

This course presupposes at least one year's previous work in physics, and an accurate knowledge of analytic geometry of two dimensions and the calculus.

The laboratory work of both courses accompanies the lectures throughout the year, and is largely quantitative, being designed to impress the principles of the subject and to impart experimental skill. In the second year, therefore, problems presenting greater difficulties, either experimental or theoretical, are assigned. Written reports of the work are required of all the students.

CHEMISTRY.

The courses in Chemistry are intended to meet the wants (1) of graduate students who make Chemistry their specialty, or who select it as one of their subordinate subjects for the degree of Doctor of Philosophy; and (2) of undergraduate students who study Chemistry for general training. The first and second years' courses cover the ground of General Chemistry, as far as it is possible to do so in the time occupied. Together they form the full course designed for undergraduates. Graduates, including those who intend to enter the Medical School, who have not done an equivalent amount of work, will follow such parts of these courses as may seem desirable.

Advanced Work for Graduate Students.

Laboratory.

Under the direction of Professors Remsen and Morse. *Daily, except Saturday, from 9 a. m. to 5 p. m.*

The work will consist in a thorough study of analytic methods in m typical preparations especially of compounds of carbon, in practice i methods of physical chemistry, and in carrying on investigations.

Lectures.

(*a*) Compounds of Carbon, by Professor Remsen. *Four t times weekly, throughout the year.*

(*b*) Historical Topics, under the direction of Professor Rem by advanced students. *About twelve lectures, second half-year*

This work, while serving to familiarize students with chemical liter is intended to aid them in acquiring the art of presenting subjects i form of lectures before audiences. All those who intend to become tea of Chemistry, are expected to take active part in the work.

(*c*) Physical Chemistry, by Dr. Jones. *Three times w through the year.*

(*d*) The Elements of Physical Chemistry, by Dr. J *Twice weekly, first-half year.*

Journal Meetings.—The instructors and advanced stu will meet weekly, on Mondays at 9 a. m., and at such other h as may be appointed, for the purpose of hearing reports o principal articles contained in the journals of Chemistry.

The journals read and regularly reported on are: Annalen der Ch Berichte der deutschen chemischen Gesellschaft, Journal of the Che Society (London), Journal für praktische Chemie, Zeitschrift für analy Chemie, Zeitschrift für physikalische Chemie, American Chemical Jou Journal of the Society of Chemical Industry, Bulletin de la Société ique, Annales de Chimie et de Physique, Zeitschrift für anorga Chemie, and occasionally others.

Collegiate Courses.

Minor Course.

(*a*) Introduction to General Chemistry.

Lectures and recitations, four hours weekly, through the year, by Pro Renouf and Dr. Gilpin.

(*b*) Laboratory Work.

Five to six hours weekly, through the year, under the direction of Pro Renouf and Dr. Gilpin.

No previous knowledge of chemistry is required. The class-room is based on Remsen's Chemistry (Briefer Course), and covers the fi inorganic chemistry, as far as possible. The last twenty class-room exe give a sketch of organic chemistry, particularly for the benefit of students whose study of chemistry is confined to the minor course. I laboratory the student repeats the experiments performed in the class-r and, in addition, has some practice in simple qualitative and quantit analysis. Each student is required to keep a note-book of his work.

Major Course.

(*a*) Advanced Inorganic Chemistry.

Lectures and recitations, four hours weekly, until Christmas, by Prof Morse.

(*b*) Chemistry of the Compounds of Carbon.

Lectures and recitations, four hours weekly, from January 2 to the end o year, by Professor Morse.

(*c*) Laboratory Work.

Five to six hours weekly, through the year, under the direction of Prof Renouf.

The class-room work in inorganic chemistry, in the major cour confined to a study of the metallic elements and to analytical chemi The laboratory work until January is systematic qualitative anal from January to the end of the year, the making of inorganic and org preparations. The compounds to be made are so chosen that the stu may become acquainted with as many classes and methods as pos The text books used are Remsen's Inorganic Chemistry (advanced cou Remsen's Organic Chemistry, and Renouf's Inorganic Preparations.

Tertiary fossils. Some of this material has been already described; while much awaits further study.

Among the most important of the special collections are:

The Williams collection of rocks and minerals, the Lewis collection of rocks and thin sections, the Krantz collection of fossils, the Hill collection of rocks and characteristic fossils from the Cretaceous formations of Texas, and the Sturtz, the Lehmann, and the Allen collections.

State Scientific Bureaus Connected with the Geological Department.

Two scientific bureaus, established by the Legislature and maintained at the expense of the State, are carried on in connection with the Geological Department. They are the Maryland Geological and Economic Survey, and the Maryland State Weather Service. Professor Clark is in charge of both of these organizations, which are concerned with a study of the geology and physical features of the State of Maryland. A sum of $27,000 annually is appropriated by the State for these bureaus.

THE BIOLOGICAL SCIENCES.

The courses in the Biological Sciences are designed (1) for students who wish to make Zoölogy, Botany, Animal Physiology, Anatomy, or Pathology a subject of advanced study and research, or the principal or a subordinate subject for the degree of Doctor of Philosophy; (2) for graduates in medicine who desire special courses in one or more of these subjects; (3) for undergraduates who desire some knowledge of the biological sciences as part of a liberal education; and (4) for undergraduates who desire to prepare themselves for the study of medicine.

The various laboratories are open daily during the session from 9 a. m. to 5 p. m. The work is conducted under the direction of the professors of the different departments.

Graduate Courses.

ZOÖLOGY AND BOTANY.

The work in Zoölogy and Botany is directed by Dr. W. K. Brooks, Professor of Zoölogy, assisted by Dr. E. A. Andrews, Associate Professor of Biology, Dr. D. S. Johnson, Associate in Botany, Dr. B. W. Barton, Lecturer in systematic Botany, and other assistants.

1. Professor Brooks will conduct the following courses, with the assistance of Dr. Andrews and Dr. Johnson.

Advanced laboratory work in Zoölogy.
Daily, throughout the year.

History of Zoölogy.
Weekly, from January to the end of the year.

Advanced lectures in Zoölogy, by instructors and fellows.
Weekly, from January 1 to April 1.

Zoölogical Journal Club.
Weekly, until April 1, for the discussion of the current literature of Zoölogy.

Zoölogical Seminary.
Weekly, from the beginning of the session until April 1.

Marine Zoölogy.
Daily, in July and August.

2. Dr. Andrews will give a course of twelve lectures on Protoplasm, in November and December.

3. Dr. Johnson will conduct the following courses:

The Comparative Morphology of the Vegetable Kingdom.
Two lectures and two laboratory exercises weekly, throughout the year.

Physiology and Histology of Plants.
Two exercises a week, throughout the year.

Botanical Journal Club.
Weekly, throughout the year.

Botanical Seminary.
Weekly, throughout the year.

PHYSIOLOGY.

The following courses in Physiology are offered to grad students:

1. By Professor Howell:

Work leading to the degree of Doctor of Philosophy, Physiology as the principal subject.

This work includes lectures, laboratory methods, research, attendance upon the meetings of the physiological seminary journal club.

2. By Professor Howell and Dr. Dreyer:

Work leading to the degree of Doctor of Philosophy Physiology as a subordinate subject. Two courses are off either of which will be accepted as absolving the conditions subordinate subject. Either course may be taken by grad students, without reference to a degree.

(*a*) The course given to medical students, consisting of a three lectures weekly throughout the year, and laboratory w six hours weekly, from October to January. This course is g in the mornings.

(*b*.) An afternoon course consisting of lectures and labora work, three afternoons weekly, from January to June.

3. By Professor Howell:

Physiological Journal Club.
Weekly, throughout the year.

4. By Professor Howell:

Physiological Seminary.
Weekly, throughout the year.

Special lectures on selected topics in Physiology by members of the or advanced students, are given occasionally as part of the Seminary

5. By Professor Howell and Dr. Dreyer:

Advanced laboratory work in Physiology, methods of den stration and research.

This course is intended for those who have completed elementary co in Physiology. The work is done individually.

ANATOMY.

The various courses given in the department of Anatomy open to graduate students. In addition, opportunities afforded for advanced work and original investigation. general outline of the work of the department follows:

I. Systematic instruction in histology, microscopic anatomy, neurology by Professor Barker and Dr. Bardeen, from Octobe to March 15, mornings.

II. Systematic instruction in gross human anatomy by Profes Mall and Dr. Harrison, from October 1 to March 15, afternoo

III. Advanced work and original investigation under direction of Professor Mall, Professor Barker, Dr. Harrison, Dr. Bardeen, daily, during the academic year.

2. Elementary Zoölogy.
Until Christmas. Professor **Brooks**.

3. Elementary Botany.
From January 2 *to April* 1. Dr. **Johnson**.

4. Embryology.
From April 1 *to the end of the session.* Associate Professor **Andrews**.

Systematic Botany.

An introduction to systematic Botany, given by Dr. **Barton** in April and May, is open to any student, without previous training, as an equivalent of part of the course in free-hand drawing.

GREEK.

Greek Seminary.

Professor **Gildersleeve** will conduct the Greek Seminary, the plan of which is based on the continuous study of some leading author or some special department of literature.

The Seminary consists of the director, fellows, and scholars, and such advanced students as shall satisfy the director of their fitness for an active participation in the work by an essay, a critical exercise, or some similar test of attainments and capacity. All graduate students, however, may have the privilege of attending the course.

During the next academic year the study of the *Greek Historians* will constitute the chief occupation of the members and Thukydides will be the centre of the work. There will be two meetings a week during the entire session. Especial attention will be paid to the development of historical style and method.

In connection with the Seminary there will be held a series of conferences on *Greek Historiography*.

The students should possess Herodotos, Thukydides, Xenophon, Polybios, Dionysios of Halikarnassos (rhetorical works), and Schäfer's Quellenkunde der griechischen Geschichte.

Advanced and Graduate Courses.

1. Professor **Gildersleeve** will also conduct a course of *Practical Exercises in Greek*, consisting chiefly in extemporaneous translation from Greek into English and English into Greek, two meetings a week from the beginning of the session to the first of January.

2. The subject of *Hermeneutics and Criticism* will be taken up in a series of conferences (Blass being the text-book).

3. A syntactical society will be organized for the promotion of research.

4. Notice of other courses is reserved.

Associate Professor **Miller** will conduct the following courses:

1. Readings twice a week in Thukydides during the first half of the year.

2. Lectures and Practical Exercises in Greek Palaeography, twice weekly during the latter half of the year.

3. Exercises in advanced Greek composition for the benefit of candidates for the degree of Doctor of Philosophy.

Undergraduate Courses.

For Candidates for Matriculation.

Homer, *Iliad* (book VI); Herodotos (book VII); Sight Reading; Prose Composition.
Three hours weekly, through the year. Associate Professor **Miller**.

Minor Course.

Isokrates, *Panegyricus*.
Three hours weekly, first half-year. Associate Professor **Spieker**.

Private Reading: Xenophon, *Hellenica* (book I).

Lysias, VII; Euripides (one play).
Three hours weekly, second half-year. Associate Professor **Spieker**

Private Reading; Homer, *Iliad* (books XVI, XVIII).

Prose Composition.
Weekly through the year. Associate Professor **Spieker**.

Major Course.

Thukydides (book VII).
Three hours weekly, first half-year. Associate Professor **Spieker**.

Private Reading: Demosthenes, *Philippics*.

Selections from the elegiac, melic, and iambic poets; Soı (one play).
Three hours weekly, second half-year. Associate Professor **Spieker**

Private Reading: Aischylos (one play).

Prose Composition.
Weekly through the year. Associate Professor **Spieker**.

Elective Course.

Demosthenes, 55; Gospel according to St. Mark.
Two hours weekly, first half-year. Associate Professor **Spieker**.

LATIN.

Latin Seminary.

Associate Professor **Kirby F. Smith** will conduct the Seminary. During the next academic year, the centre o will be Roman Satire. There will be two meetings a week th out the year devoted to critical interpretation, to various au studies, and to the presentation of papers prepared by mem the Seminary. In the first half of the year, more particulaı tion will be given to Horace; in the second half, to Juven

Students are advised to provide themselves in advance with Kel Holder's Editio Minor of Horace (Leipzig, Teubner, 1878), Ki Satires of Horace (2nd edition, Weidmann, Berlin, 1895), Bue edition of Persius and Juvenal (Weidmann, 1893), Buecheler's ed Petronius, including the fragments of the *Saturae Menippeae* of Va Seneca's *Apocolocyntosis* (Weidmann, 1895), Baehrens' *Fragmenta* *Romanorum* (Teubner, Leipzig, 1886), and van der Vliet's A *Metamorphoses* (Teubner, 1898). Books to be used in other cour be announced later.

Advanced and Graduate Courses.

1. Throughout the year, Associate Professor Smith will once a week on Roman Satire.

2. During the first half-year, he will read with a class, week, Seneca's *Apocolocyntosis* and part of Petronius.

3. During the second half-year, he will read selection Apuleius, with a class, once a week.

4. A Journal Club will meet regularly to report on philological periodicals containing articles of interest to La

5. During the first half-year, Dr. H. L. Wilson will on Latin Palaeography, once a week, with practical ex in reading fac-similes of manuscripts.

6. During the second half-year, he will lecture, once a we Historical Latin Grammar.

B. Linguistic Science and Comparative Grammar of the Indo-European Languages.

6. The Elements of Linguistic Science, with an introductory account of the Ethnology of the Indo-European peoples.
Weekly, through the year.

7. The elements of Phonetics.
Weekly conferences from the opening of the session until Christmas.

8. Comparative Grammar of Greek, Latin, German, and Sanskrit. The history of the Indo-European consonants.
Weekly, through the year.

9. Introduction to the Old-Bulgarian (Church-Slavonic) language.
Weekly, through the year.

No knowledge of Sanskrit is required for any of the courses under B. Course 6 sketches briefly the history of the science of language; presents a concise account of the ethnological history of the Indo-European (Aryan) peoples; deals with the fundamental questions of growth and change in language; and finally treats of the origin of language. Course 7 will be carried on in practical conferences, for the purpose of familiarizing students of language and philology in general with the nature of spoken sounds. Course 8 is intended as an introduction into the most elementary methods and results of the comparative grammar of the most important Indo European languages. Course 9 is to be given for the first time in this University; it was preceded for the last two years by an elementary and advanced course in Lithuanian; these two most important languages of the Balto-Slavic family will hereafter be treated alternately from year to year.

ENGLISH.

A.

Professor Bright will conduct the following courses:

I.

English Seminary.

Graduate students are admitted to the Seminary as soon as they have satisfied initial requirements for independent research. The discipline of the Seminary is designed to impart training in scholarly methods of dealing with literary and linguistic problems. Study and investigation are bestowed upon selected periods of literary history, upon departments of literature extending through successive periods, and upon the works of important writers, separately or in groups. Usually there is a change of subject each half-year.

The following subjects are announced for the academic year beginning October 1, 1899: (*a*) Epic poetry in England, especially the *Beowulf*, and Milton's *Paradise Lost* (*first half-year*); (*b*) The Prose Literature of the reign of King Alfred the Great (*second half-year*).

The meetings of the Seminary will occupy four hours a week. *Tuesday and Thursday*, 3–5 *p. m.*

II.

Lectures on English Grammar. *Thursday*, 12 *m.*, *first half-year; Wednesday*, 4 *p. m.*, *second half-year.*

III.

The Interpretation of Texts: (*a*) *The Lay of Havelok the Dane. Monday*, 11 *a. m.*, *first half-year;* (*b*) Early Plays. *Monday*, 11 *a. m. and Tuesday*, 12 *m.*, *second half-year.*

Students will be required to provide themselves with Skeat's edition of *The Lay of Havelok the Dane* (Early English Text Society, Extra Series, No. IV, 1868), and Alois Brandl's *Quellen des weltlichen Dramas in England vor Shakespeare* (*Quellen und Forschungen*, No. LXXX, Strassburg, 1898).

IV.

The English Journal Club (*fortnightly, two hours*), for reports on the current journals, reviews of new books, and the presentation and discussion of original papers on linguistic and literary subjects.

V.

An introductory course in Anglo-Saxon, with Bright's Anglo-Saxon Reader as the text-book. *Monday and Wednesday*, 12 *m.*

B.

Professor Browne will give the following courses in English Literature:

VI.

A general course covering the whole field, from the 7th to the 19th century. The study, of course, is synoptical; but emphasis is laid upon the chief writers and most important periods. Morley's *Manual* (Tyler's edition) is used as a text-book. *Wednesday and Thursday*, 1 *p. m.*

VII.

A course in the writers of the 12th, 13th, and 14th centuries (from the Peterborough Chronicle to Chaucer). The texts are read from Morris and Skeat's *Specimens*, the students beginning with the easier and proceeding to the more difficult. In addition to the knowledge thus acquired of an interesting and formative period of our literature, this introduction to the early forms of the language will be found a helpful prodromus to the study of Anglo-Saxon. *Monday and Tuesday*, 1 *p. m.*

VIII.

A course in the writers of the Elizabethan period. The origin and development of the English drama will be traced from its earliest recorded beginnings down to Shakespeare, the representative of its highest perfection, and in its decadence in the later Jacobean dramatists. *Tuesday*, 12 *m.*, *first half-year.*

IX.

A course in the literature of the first half of the 19th century. *Tuesday*, 12 *m.*, *second half-year.*

X.

The Early Scottish Poetry from Barbour (A. D. 1350) to Lyndsay (A. D. 1550) will be studied by the aid of a chrestomath[illegible] especially prepared for this class. A course of historical an[illegible] critical lectures will be given concurrently with the reading[illegible] *Friday*, 12 *m.*

XI.

Lectures, for advanced students, on the Scottish Poets fro[illegible] Lyndsay to Burns. *Wednesday*, 11 *a. m.*

C.

Professor Greene will give the following courses in Rhetoric and in English Literature:

Prose Readings: Baumbach, *Erzählungen und Märchen;* Chamisso, *Peter Schlemihl.*

Weekly, through the year. Dr. Vos.

Prose Composition.

Weekly, through the year. Professor Wood.

Private Reading: Gutzkow, *Zopf und Schwert.*

Class B:

Otis, *Elementary German;* Brandt, *German Reader;* von Moser, *Der Bibliothekar;* Goethe, *Egmont;* Prose Composition (E. S. Buchheim, *Elementary German Prose Composition,* Oxford, 1893); Whitney, *German Grammar.*

Four hours weekly, through the year. Dr. Baker.

Minor Course B is intended only for students who have matriculated in Greek, and have fully met *at entrance* the matriculation requirements; for such students, it absolves the requirements in German. Other students must absolve Minor A.

Major Course.

Drama.

Goethe, *Faust.* Professor Wood. Schiller, *Wallensteins Lager, Die Piccolomini.* Mr. Hofmann.

Two hours weekly, through the year.

History of German Literature: Classical Period.

Weekly, through the year. Associate Professor Vos.

Prose Composition.

C. A. Buchheim, *Materials for German Prose Composition,* Parts I and II, London, 1894.

Weekly, through the year. Professor Wood and Mr. Hofmann.

Private Reading: Schiller, *Wallensteins Tod.*

Elective Course.

Contemporary Literature, in Rapid Readings.

Works by Hauptmann, Sudermann, Ebner-Eschenbach, and von Wildenbruch are read.

Two hours weekly, through the year. Dr. Baker.

This course is intended for students who have completed the equivalent of a Minor.

Special Courses.

Courses 1 and 2 are open to graduate students who already possess an elementary knowledge of German and wish to acquire greater fluency in reading. The first is intended for students in Languages, History, and Economics; the second, for students in the Natural Sciences. Successful completion of either course is accepted as an equivalent of the reading knowledge of German required of candidates for the degree of Doctor of Philosophy.

1. Historical German.

Seiler, *Die Heimat der Indogermanen;* Hoffmann's *Historische Erzählungen;* Lange, *Athen im Spiegel der aristophanischen Komödie.*

Twice weekly. Dr. Baker.

2. Scientific German.

Dippold, *Scientific German Reader;* von Helmholtz, *Über Goethe's naturwissenschaftliche Arbeiten.*

Twice weekly. Dr. Baker.

This course is open to graduate students who already possess an elementary knowledge of German, and wish to acquire greater fluency in reading.

3. Oral Exercises in German.

Twice weekly. Mr. Hofmann.

This course is intended especially for students in the departments of modern languages, who lack an extended vocabulary and sufficient familiarity with written and spoken German. A thorough knowledge of the elements is presupposed.

ROMANCE LANGUAGES.

Advanced Courses.

I. With second and third year students:

Professor Elliott.

(*a*). Seminary. *Twice weekly.*

The Fables of Marie de France; Work on Manuscripts.

(*b*). French Dialects. *Weekly.*

(*c*). Lectures on Dante. *Weekly.*

(*d*). Romance Club. *Weekly.*

Professor F. M. Warren.

(*e*). The Breton Cycle. *Twenty lectures in the month of 1*
ruary.

(*f*). The Mediæval French Drama. *Four lectures.*

(*g*). The Modern French Drama. *Eight public lectures.*

[I. The Theatre of Corneille, Molière, and Racine. II. Volta
Work as a Playwright. III. La Chaussée's Innovations. D
rot's Reform. IV. Shakespeare's Influence. V. The Roma
School. Victor Hugo. VI. Dumas, De Vigny, Musset, Scr
VII. The *drame,* Dumas *fils,* Sardou. VIII. Symbolism on
Stage. The Plays of To-day.]

Associate Professor Marden.

(*h*). Spanish Philology. *Twice weekly.*

Gorra, *Lingua e Letteratura Spagnuola delle Origini;* Baist,
Spanische Sprache (in Gröber's *Grundriss der Romanischen P*
logie); Meyer-Lübke, *Grammaire des Langues Romanes,* vols I

(*i*). Old Spanish Readings. *Weekly.*

Gorra, *Lingua e Litteratura Spagnuola delle Origini;* Lidforss,
Cantares de Myo Cid; Janer, *Poetas Castellanos anteriores al*
XV.

(*j*). Spanish Seminary. Poema de Fernan Gonzalez. *T*
weekly.

(*k*). Lectures on the Early Spanish Drama. *Weekly.*

II. With first year students:

Professor Elliott.

(*a*). Popular Latin. *Weekly.*

(*b*). French Physiological Phonetics. *Weekly.*

Passy, *Les sons du français;* Beyer, *Französiche Phonetik;* Sw
Primer of Phonetics; Vietor, *Elemente der Phonetik;* Micha
and Passy, *Dictionnaire Phonétique de la Langue Française.*

Associate Professor Rambeau.

(*c*). Phonetics and French pronunciation, with practical e
cises. *Weekly, second half-year.*

A. Rambeau and Jean Passy, *Chrestomathie française,* Holt, N
York, 1897; Paul Passy, *Les sons du français,* 4th edition, 18

Dr. Brush.

(*d*). Old French Phonology and Morphology. *Three hou*
weekly.

Schwan-Behrens, *Grammatik des Altfranzösichen;* Suchier, *Le Fra*
çais et le Provençal; Suchier, *Altfranzösiche Grammatik;* Körtin
Lateinisch-romanisches Wörterbuch; Nyrop, *Grammaire historiq*
de la langue française.

(*e*). Elementary Course in Old French Readings. *Weekly.*

Texts: Paris and Jeanroy: *Extraits des Chroniquers français;*
Paris: *Extraits de la Chanson de Roland;* Saintsbury: *Les S*
ments de Strasbourg, and *La Cantilène de Sainte Eulalie;* Suchi
Aucassin u. Nicolete; Warnke: *Die Lais der Marie de France.*

(*f*). Advanced Course in Old French Readings. *Twice weekly.*
First Semester: The Arthurian Cycle.
Texts: Foerster: *Kristian von Troyes Erec u. Enide*, Halle, 1896; Foerster: *Li Chevaliers as deus Espées*, Halle, 1877; Friedwagner: *Meraugis von Portlesguer*, Halle, 1897; Stengel: *Durmart le Galois*, Tübingen, 1873.

Second Semester: Early French Lyrics.
Texts: Bartsch: *Romanzen u. Pastourellen*, Leipzig, 1870; Brakelmann: *Les Plus Anciens Chansonniers Français*, Part 1, Paris, 1891; Part 2, Marburg, 1896.

Dr. KEIDEL.

(*g*). Methodology of the Romance Languages. *Weekly, first half-year.*

(*h*). Paleography. *Weekly, second half-year.*

Dr. OGDEN.

(*i*). Lyric Expression in French Literature from the Times of the Renaissance. *Weekly.*

(*j*). Provençal. *Weekly.*
Appel's *Chrestomathie.*

Undergraduate Courses.

Associate Professor RAMBEAU.

French: *Second Year* (*Major*) *Course.*

Outline of the History of French Literature from the beginnings to the XIXth century, especially the XVIIth century; study of Classical Tragedy and Comedy.
Rapid reading of Corneille, Racine, Voltaire, and especially Molière. *Twice weekly.*

2. Literature of the XIXth century, especially the Romantic Movement.
Chateaubriand; Victor Hugo (novel, drama, lyrics); Béranger; Lamartine; Alfred de Musset; the *Parnassiens.* *Weekly.*

Private reading.

3. Prose Composition.
Study of idioms and original essays with reference to subjects and authors read in the class. *Weekly.*

French: *First Year* (*Minor*) *Course: Class A.*

1. Short outline of the History of French Literature (XVII–XIX centuries), and reading of *Contes*, Novels, and Dramas.
Coppée, *Contes*; Mérimée, *Colomba*; Molière, *L'Avare*; Hugo, *Hernani*; Béranger, *Chansons.* *Twice weekly.*

2. Modern French Comedy.
Labiche and Martin, *Moi*; Augier, *Le Gendre de M. Poirier*; Rostand, *Cyrano de Bergerac.* *Weekly.*

Private reading.

3. Prose Composition and Syntax.
Bevier's Grammar with Exercises by Logie, and Exercises based on *Colomba*, ed. Kimball. *Weekly.*

French: *Elementary Course.*
Grandgent's *Short French Grammar*; Super's *French Reader*; Grandgent's Exercises based on Super's *French Reader*; Jules Verne, *L'Expédition de la Jeune-Hardie*; Thiers, *Expédition de Bonaparte en Égypte.*
For candidates for matriculation who offer Greek. *Three hours weekly.*

French: *Elective Course.*
Loti, *Pêcheurs d'Islande*; Taine, *Les Origines de la France contemporaine*; selected stories by Coppée, Daudet, and others; French lyrics.
For students who have completed the equivalent of a Minor. *Twice weekly.*

Dr. OGDEN.

French: *First Year* (*Minor*) *Course: Class B.*
Whitney's *Brief French Grammar*; Exercises in Grammar and Composition; Exercises in Prose Composition based on texts used; Super's *French Reader*; Dumas, *L'Évasion du Duc de Beaufort*; Mérimée, *Colomba*; Augier, *Le Gendre de M. Poirier.*
For undergraduates who have matriculated in Greek, and for graduates beginning French. *Four hours weekly.*

Associate Professor MARDEN.

Spanish: *Minor Course.* *Four hours weekly.*
Manning's *Spanish Grammar*; Matzke's *First Spanish Readings*; Alarcón, *El Capitán Veneno*; Galdós, *Doña Perfecta*; Tamayo, *Un drama nuevo.*

Spanish: *Elective Course.* *Twice weekly.*
Manning's *Spanish Grammar*; Matzke's *First Spanish Readings*; Palacio Valdés, *José*; Tamayo, *Un drama nuevo.*

Dr. BRUSH.

Italian: *Minor Course.* *Four hours weekly.*
Grandgent's Italian Grammar and Composition.
Fornaciari, *Sintassi italiana*; Fornaciari, *Disegno storico della letteratura italiana*; Guarnerio, *Manuale di versificazione italiana.*
De Amicis, *Cuore*, ed. Kuhns, and other novels; Manzoni, *I Promessi Sposi*; Verga, *Vita dei Campi*; Serao, *All'erta, sentinella!*; Foscolo, *Liriche scelte* (ed. Ferrari); a comedy of Goldoni; a tragedy of Alfieri; selections from Tasso's *Gerusalemme liberata* and Dante's *Divina Commedia.*

Dr. OGDEN.

Italian: *Elective Course.* *Twice weekly.*
Del Testa, *L'Oro e l'Orpello*; De Amicis, *Alberto*, *Camilla*; Farina, *Fra le Corde d'un Contrabbasso*; Barrili, *La Donna di Picche*; Verga, *Cavalleria Rusticana*; Capuana, *Homo.*

HISTORY, POLITICS, AND ECONOMICS.

History.

Professor HERBERT B. ADAMS:

1. Historical Seminary.
Alternate Friday evenings. For graduates only.
2. Early History of Society and Institutions.
Two hours weekly, first half-year. For graduates.
3. Greek Politics.
Two hours weekly, second half-year. For graduates.
4. History of Education.
One hour weekly, first half-year. For graduates.
5. Educational Conference. Class Lectures.
One hour weekly, second half-year. For graduates.
6. Civilization and Politics in the Far East.
Two hours weekly, through the year. For undergraduates; open to graduates.

Associate Professor JOHN MARTIN VINCENT:

1. The Reformation.
Two hours weekly, first half-year. For graduates.
2. The Puritan Revolution.
Two hours weekly, second half-year. For graduates.
3. Historical Conference, for the study of practical problems in historical research.
Two hours fortnightly, through the year. For graduates.
4. European History.
Two hours weekly, through the year. Part of "Major History."
5, Historical Politics.
Two hours weekly, through the year. Part of "History-Economics."

DR. BERNARD C. STEINER, Associate in History:

American Political and Constitutional History.
Two hours weekly, through the year. For undergraduates; open to graduates.

Dr. J. C. Ballagh, Associate in History:

1. Classical and Early European History.
   Four hours weekly, through the year. For undergraduates.
2. Southern Industrial History.
   One hour weekly, through the year. For graduates.
3. Oral Examinations in History.
   One hour weekly, through the year. For graduates.
4. National Expansion of the United States.
   Six special lectures to graduates and others.

Dr. J. M. Callahan, Albert Shaw Lecturer in American Diplomatic History:

1. America in the Pacific.
   Twelve lectures. For graduates.
2. Diplomatic History of the Southern Confederacy.
   Twelve lectures. For graduates.

Dr. Guy Carleton Lee, Instructor in History:

1. English Political and Constitutional History.
   Two hours weekly, through the year. For undergraduates.
2. History of English Law.
   One hour weekly, through the year. For graduates and law students.
3. Parliamentary Law and Practice.
   One hour weekly, through the year. For undergraduates.
4. Public Speaking and Class Debates.
   Six hours weekly, through the year. For undergraduates.
5. Public Speaking and Lecturing.
   One hour weekly, first-half year. For graduates.

Economics.

Associate Professor **Sidney Sherwood**:

1. Economic Conference. Special topic: "The Foreign Commerce and Commercial Policy of the United States."
   Two hours weekly, through the year. For graduates.
2. Commerce.
   Two hours weekly, first half-year. For graduates.
3. Transportation.
   Two hours weekly, second half-year. For graduates.
4. Principles of Economics.
   One hour weekly, throughout the year. For graduates.
5. Elements of Economics.
   Two hours weekly, first half-year. Required of all undergraduates.
6. Recent Economic Theories.
   Two hours weekly, second half-year. For undergraduates; open to graduates.

Associate Professor **J. H. Hollander**.

1. Development of Economic Thought before Adam Smith.
   Two hours weekly, first half-year. For graduates.
2. Municipal Finance.
   Two hours weekly, second half-year. For graduates.
3. Recent Economic Changes.
   Two hours weekly, first half-year. For graduates and undergraduates.
4. History of Economic Thought.
   Two hours weekly, first half-year. For undergraduates in Group VI.
5. International Trade and Socialism.
   Two hours weekly, second half-year. For undergraduates in Group VI.
6. Money and Taxation.
   Two hours weekly, second half-year. Required of all undergraduates.

Politics.

Associate Professor **W. W. Willoughby** will conduct the following courses:

1. History of Ancient Political Philosophy.
   Two hours weekly, first half-year. For graduates.
2. History of Mediaeval Political Philosophy.
   Two hours weekly, second half-year. For graduates.
3. Comparative Constitutional Law.
   Two hours weekly, throughout the year. For graduates.
4. Political Conference.
   Fortnightly, throughout the year. For graduates.

Public Aid, Charity, and Correction.

Dr. J. R. Brackett will represent these subjects as follows:

1. Class lectures on Charitable and Correctional Legislation Europe and America.
   One hour weekly, through the year. For graduates and specialists.
2. Weekly Conference on Public Aid, Charity, and Correction.

PHILOSOPHY.

The undergraduate courses in Philosophy provide five hou per week of work for one year, under the direction of Profess **Griffin**. All candidates for the degree of Bachelor of Arts a required to follow them during the last year of residence.

1. Deductive and Inductive Logic.

   The logical forms—terms, propositions, syllogisms—are studied as analysis or explanation of the thinking process, and as a practical d cipline in exact thought: attention is given also to the material elemer in inference, as these are stated in the several inductive methods.

   Jevons's Elementary Lessons in Logic and Fowler's Elements of Inducti Logic are used as text-books, with references to the works of Mill, Bai Keynes, and other writers.

   Four hours weekly, until Christmas.

2. Psychology.

   The instruction in psychology is intended to give a general view of results of the present methods of study, the investigations in regard to t quality and intensity of sensations, the duration of psychic acts, etc.— general, the subjects treated in Part II of Ladd's Physiological Psycholo —being presented with sufficient detail to render them intelligible a interesting. A series of lectures and demonstrations on the anatomy physiology of the nervous system, by Dr. L. F. Barker, is included in course.

   Especial emphasis is laid upon the facts of conscious experience known through introspection, the most important end to be secured bei it is believed, such an understanding of the facts and laws of mental life shall fit one for wise self-government and effective influence. With view, such powers and states of mind as attention, memory, associat habit, imagination, the feelings, the will, are discussed in as concrete practical a way as possible. A text-book is used as a basis of instruct but this is largely supplemented by informal lectures, and by reference various authorities.

   Baldwin's Elements of Psychology, Sully's Human Mind, Jam Psychology, Höffding's Outlines of Psychology, Dewey's Psycholo Hamilton's Lectures on Metaphysics, Porter's Human Intellect, Spence Principles of Psychology, Ladd's Physiological Psychology, are used books of reference. One essay on an assigned subject is required from eac member of the class.

   Fours hours weekly, during January; five hours, from February 1 *to April* 1

3. Ethics.

   Ethics is treated with reference to its fundamental problems as a theoretical science and also from a practical point of view. Its psychological basi in the various forms of feeling native to our constitution, and in the powe of rational self-determination; the nature of the sense of obligation; th authority of conscience; the diversities of moral opinion; the histor theories of morals—hedonism, utilitarianism, intuitionism, and the appl cation to ethical theory of the doctrine of evolution;—these are some the topics discussed.

DEGREES CONFERRED JUNE 13, 1899.

The public exercises of Commencement were held in the Academy of Music at 4 p. m., Tuesday, June 13, 1899. Degrees were conferred on thirty-eight bachelors of arts, thirty-eight doctors of philosophy, and thirty-two doctors of medicine, and certificates were given to five proficients in Applied Electricity (see lists below.) The honors of the year and the recent appointments were announced by the President (see page 90 of this *Circular*.) In the evening a reception to the graduates and their friends was given in McCoy Hall.

DOCTORS OF PHILOSOPHY.

THOMAS SEWELL ADAMS, of Baltimore, A. B., Johns Hopkins University, 1896. *Subjects:* Economics, Politics, and History of Philosophy. *Dissertation:* Index Numbers and the Standard of Value. *Referees on dissertation:* Professors Newcomb and Sherwood, and Dr. Hollander.

JOHN WILLIAM BASORE, of Broadway, Va., A. B., Hampden-Sidney College, 1893. *Subjects:* Latin, Greek, and Sanskrit. *Dissertation:* A Study of Ὑπόκρισις in the Commentary of Donatus to the Plays of Terence. *Referees on dissertation:* Professors Warren and Smith.

EDWARD WILLIAM BERGER, of Berea, O., Ph. B., Baldwin University, 1894. *Subjects:* Zoology, Physiology, and Botany. *Dissertation:* The Cubomedusae: Physiological and Histological; with Dr. F. S. Conant's Notes on the Physiology. *Referees on dissertation:* Professors Brooks and Howell.

WILLIAM NOLAND BERKELEY, of Charlottesville, Va., S. B., St. John's College, 1896. *Subjects:* Chemistry, Geology, and Physics. *Dissertation:* An Investigation of the Relative Rate of Reduction of Nitrobenzoic Acids. *Referees on dissertation:* Professors Remsen and Morse.

PIERCE BUTLER, of New Orleans, La., A. B., Tulane University, 1892. *Subjects:* English, French, and History. *Dissertation:* Legenda Aurea—Légende Dorée—Golden Legend: A Study of Caxton's Golden Legend, with special reference to its Relations to the Earlier English Prose Translation. *Referees on dissertation:* Professors Bright and Browne.

HORACE GREELEY BYERS, of Pulaski, Pa., A. B. and S. B., Westminster College (Pa.), 1895. *Subjects:* Chemistry, Physics, and Mathematics. *Dissertation:* A Study of the Reduction of Permanganic Acid by Manganese Dioxide. *Referees on dissertation:* Professors Remsen and Morse.

JOSEPH SCUDDER CHAMBERLAIN, of Hudson, O., S. B., Iowa Agricultural College, 1890. *Subjects:* Chemistry, Biology, and Geology. *Dissertation:* A Further Study of two of the Products of Transformation of Parasulphaminebenzoic Acid when heated to 220°. *Referees on dissertation:* Professors Remsen and Morse.

FRANCIS WHITTEMORE CRAGIN, of Colorado Springs, Colo., S. B., Harvard University, 1882. *Subjects:* Geology, Mineralogy, and Zoology. *Dissertation:* The Paleontology of the Malone Jurassic Formation of Texas. *Referees on dissertation:* Professor Clark and Dr. Matthews.

GEORGE VAIL EDWARDS, of Riverhead, N. Y., A. B., Hamilton College, 1891. *Subjects:* Latin, Sanskrit, and Greek. *Dissertation:* The Ablative and Genitive of Quality. *Referees on dissertation:* Professors Warren and Smith.

OLIVER LANARD FASSIG, of Baltimore, S. B., Ohio State University, 1882. *Subjects:* Geology, Physics, and Petrography. *Dissertation:* March Weather in the United States, with special reference to the Middle Atlantic States: A Study of the Relations existing between Mean Atmospheric Pressure and the General Characteristics of the Weather and Storms in March. *Referees on dissertation:* Professors Clark and Abbe.

GEORGE STRONACH FRAPS, of Raleigh, N. C., S. B., North Carolina Agricultural College, 1896. *Subjects:* Chemistry, Physics, and Geology. *Dissertation:* The Composition of a Wood Oil. *Referees on dissertation:* Professors Remsen and Morse.

PIERRE JOSEPH FREIN, of Great Barrington, Mass., A. B., Williams College, 1892. *Subjects:* French, Italian, and History. *Dissertation:* Phonology of the Patois of Pleigne (Canton de Berne). *Referees on dissertation:* Professor Elliott and Dr. Armstrong.

LEONIDAS CHALMERS GLENN, of Crowder's Creek, N. C., A. B., University of South Carolina, 1891. *Subjects:* Geology, Mineralogy, and Biology. *Dissertation:* A Contribution to the Study of the Pelecypoda of the Miocene [illegible]land. *Referees on dissertation:* Professors Clark and Reid.

CASWELL GRAVE, of Monrovia, Ind., S. B., Earlham College, 1895. *Subjects:* Zoology, Botany, and Physiology. *Dissertation:* Ophiura Brevispina, Say. *Referees on dissertation:* Professors Brooks and Andrews.

NATHANIEL EDWARD GRIFFIN, of Baltimore, A. B., Johns Hopkins University, 1894. *Subjects:* English, German, and History of Philosophy. *Dissertation:* A Study of the Middle English "Sege of Troye." *Referees on dissertation:* Professors Bright and Browne.

KARL JOSEF GRIMM, of Baltimore. *Subjects:* Biblical Philology, Assyrian, and History of Philosophy. *Dissertation:* Euphemistic Liturgical Appendixes in the Old Testament. *Referees on dissertation:* Professor Haupt and Professor George F. Moore, of Andover, Mass.

HOLLISTER ADELBERT HAMILTON, of Rochester, N. Y., A. B., University of Rochester, 1892. *Subjects:* Greek, Latin, and Sanskrit. *Dissertation:* The Negative Compounds in Greek. *Referees on dissertation:* Professors Gildersleeve and Spieker.

WILLIS BOIT HOLMES, of Cambridge, Mass., A. B., Harvard University, 1896. *Subjects:* Chemistry, Geology, and Mineralogy. *Dissertation:* A Further Investigation of the Chlorides of Orthosulphobenzoic Acid and Paranitroorthosulphobenzoic Acid. *Referees on dissertation:* Professors Remsen and Morse.

GEORGE OSCAR JAMES, of Bowers Hill, Va., A. B., Johns Hopkins University, 1895. *Subjects:* Mathematics, Physics, and Astronomy. *Dissertation:* On the Differential Equations connected with Hypersurfaces. *Referees on dissertation:* Professors Newcomb and Craig.

JAMES WILLIAM KERN, of Alexandria, Va., University of Va., 188[illegible] *Subjects:* Greek, Sanskrit, and Latin. *Dissertation:* Ἀνά and Κατά in Composition and with Case. *Referees on dissertation:* Professors Gildersleeve and Miller.

WILLIAM KURRELMEYER, of Baltimore, A. B., Johns Hopkins University, 1896. *Subjects:* German, French, and Sanskrit. *Dissertation:* The Historical Development of the Types of the First Person Plural Imperative in German. *Referees on dissertation:* Professors Wood and Vos.

ALVIN FAYETTE LEWIS, of Bowling Green, Ky., A. B., Princeton University, 1884. *Subjects:* History, Economics, and the History of Philosophy. *Dissertation:* A History of Education in Kentucky. *Referees on dissertation:* Professors Adams and Vincent.

JOSEPH FRANCIS MERRILL, of Richmond, Utah, S. B., University Michigan, 1893. *Subjects:* Physics, Electricity, and Mathematics. *Dissertation:* Influence of the Surrounding Dielectric on the Conductivity [illegible] Copper Wires. *Referees on dissertation:* Professors Rowland and Ames.

ALFRED WILLIAM MILDEN, of Cornwall, Ont., A. B., University [illegible] Toronto, 1888. *Subjects:* Greek, Latin, and Sanskrit. *Dissertation:* Ph[illegible]s of Oblique Predication in Greek. *Referees on dissertation:* Professors Gildersleeve and Miller.

DANIEL ESTEN MOTLEY, of Chatham, Va., A. B., Milligan College (Tenn.), 1894. *Subjects:* History, Economics, and History of Philosophy. *Dissertation:* Life of Commissary James Blair, William and Mary College. *Referees on dissertation:* Professor Adams and Dr. Ballagh.

ROKURO NAKASEKO, of Kyoto, Japan, Doshisha University, 1889. *Subjects:* Chemistry, Physiology, and Biology. *Dissertation:* Some Transformations of Metasulphaminebenzoic Acid under the Influence of Heat. *Referees on dissertation:* Professors Remsen and Morse.

WILLIAM ALBERT NITZE, of Baltimore, A. B., Johns Hopkins University, 1894. *Subjects:* French, Italian, and German. *Dissertation:* A Study of the Perlesvaus. *Referees on dissertation:* Professor Elliott and Dr. F. M. Warren.

FREDERICK ALBERT SAUNDERS, of Ottawa, Canada, A. B., University of Toronto, 1895. *Subjects:* Physics, Mathematics, and Astronomy. *Dissertation:* A Bolometric Study of the Spectrum of an Absolutely Black Body between the Temperatures of 100° and 578° Centigrade. *Referees on dissertation:* Professors Rowland and Ames.

LAURENCE FREDERICK SCHMECKEBIER, of Baltimore, A. B., Johns Hopkins University, 1896. *Subjects:* History, Economics, and Politics. *Dissertation:* History of the Know-Nothing Party in Maryland. *Referees on dissertation:* Professor Adams and Dr. Steiner.

ST. GEORGE LEAKIN SIOUSSAT, of Lake Roland, Md., A. B., Johns Hopkins University, 1896. *Subjects:* History, Politics, and Economics. *Dissertation:* History of Highway Legislation in Maryland, and its Influence on

B. Linguistic Science and Comparative Grammar of the Indo-European Languages.

6. The Elements of Linguistic Science, with an introductory account of the Ethnology of the Indo-European peoples.
Weekly, through the year.

7. The elements of Phonetics.
Weekly conferences from the opening of the session until Christmas.

8. Comparative Grammar of Greek, Latin, German, and Sanskrit. The history of the Indo-European consonants.
Weekly, through the year.

9. Introduction to the Old-Bulgarian (Church-Slavonic) language.
Weekly, through the year.

No knowledge of Sanskrit is required for any of the courses under B. Course 6 sketches briefly the history of the science of language; presents a concise account of the ethnological history of the Indo-European (Aryan) peoples; deals with the fundamental questions of growth and change in language; and finally treats of the origin of language. Course 7 will be carried on in practical conferences, for the purpose of familiarizing students of language and philology in general with the nature of spoken sounds. Course 8 is intended as an introduction into the most elementary methods and results of the comparative grammar of the most important Indo European languages. Course 9 is to be given for the first time in this University; it was preceded for the last two years by an elementary and advanced course in Lithuanian; these two most important languages of the Balto-Slavic family will hereafter be treated alternately from year to year.

ENGLISH.

A.

Professor Bright will conduct the following courses:

I.

English Seminary.

Graduate students are admitted to the Seminary as soon as they have satisfied initial requirements for independent research. The discipline of the Seminary is designed to impart training in scholarly methods of dealing with literary and linguistic problems. Study and investigation are bestowed upon selected periods of literary history, upon departments of literature extending through successive periods, and upon the works of important writers, separately or in groups. Usually there is a change of subject each half-year.

The following subjects are announced for the academic year beginning October 1, 1899: (*a*) Epic poetry in England, especially the *Beowulf*, and Milton's *Paradise Lost* (*first half-year*); (*b*) The Prose Literature of the reign of King Alfred the Great (*second half-year*).

The meetings of the Seminary will occupy four hours a week. *Tuesday and Thursday*, 3–5 *p. m.*

II.

Lectures on English Grammar. *Thursday*, 12 *m., first half-year; Wednesday*, 4 *p. m., second half-year.*

III.

The Interpretation of Texts: (*a*) *The Lay of Havelok the Dane. Monday*, 11 *a. m., first half-year;* (*b*) Early Plays. *Monday*, 11 *a. m. and Tuesday*, 12 *m., second half-year.*

Students will be required to provide themselves with Skeat's edition of *The Lay of Havelok the Dane* (Early English Text Society, Extra Series, No. IV, 1868), and Alois Brandl's *Quellen des weltlichen Dramas in England vor Shakespeare* (*Quellen und Forschungen*, No. LXXX, Strassburg, 1898).

IV.

The English Journal Club (*fortnightly, two hours*), for reports on the current journals, reviews of new books, and the presentation and discussion of original papers on linguistic and literary subjects.

V.

An introductory course in Anglo-Saxon, with Bright's Anglo-Saxon Reader as the text-book. *Monday and Wednesday*, 12 *m.*

B.

Professor Browne will give the following courses in English Literature:

VI.

A general course covering the whole field, from the 7th to the 19th century. The study, of course, is synoptical; but emphasis is laid upon the chief writers and most important periods. Morley's *Manual* (Tyler's edition) is used as a text-book. *Wednesday and Thursday*, 1 *p. m.*

VII.

A course in the writers of the 12th, 13th, and 14th centuries (from the Peterborough Chronicle to Chaucer). The texts are read from Morris and Skeat's *Specimens*, the students beginning with the easier and proceeding to the more difficult. In addition to the knowledge thus acquired of an interesting and formative period of our literature, this introduction to the early forms of the language will be found a helpful prodromus to the study of Anglo-Saxon. *Monday and Tuesday*, 1 *p. m.*

VIII.

A course in the writers of the Elizabethan period. The origin and development of the English drama will be traced from its earliest recorded beginnings down to Shakespeare, the representative of its highest perfection, and in its decadence in the later Jacobean dramatists. *Tuesday*, 12 *m., first half-year.*

IX.

A course in the literature of the first half of the 19th century. *Tuesday*, 12 *m., second half-year.*

X.

The Early Scottish Poetry from Barbour (A. D. 1350) to Lyndsay (A. D. 1550) will be studied by the aid of a chrestomathy especially prepared for this class. A course of historical and critical lectures will be given concurrently with the readings. *Friday*, 12 *m.*

XI.

Lectures, for advanced students, on the Scottish Poets from Lyndsay to Burns. *Wednesday*, 11 *a. m.*

C.

Professor Greene will give the following courses in Rhetoric and in English Literature:

Prose Readings: Baumbach, *Erzählungen und Märchen;* Chamisso, *Peter Schlemihl.*

Weekly, through the year. Dr. Vos.

Prose Composition.

Weekly, through the year. Professor Wood.

Private Reading: Gutzkow, *Zopf und Schwert.*

Class B:

Otis, *Elementary German;* Brandt, *German Reader;* von Moser, *Der Bibliothekar;* Goethe, *Egmont;* Prose Composition (E. S. Buchheim, *Elementary German Prose Composition*, Oxford, 1893); Whitney, *German Grammar.*

Four hours weekly, through the year. Dr. Baker.

Minor Course B is intended only for students who have matriculated in Greek, and have fully met *at entrance* the matriculation requirements; for such students, it absolves the requirements in German. Other students must absolve Minor A.

Major Course.

Drama.

Goethe, *Faust.* Professor Wood. Schiller, *Wallensteins Lager, Die Piccolomini.* Mr. Hofmann.

Two hours weekly, through the year.

History of German Literature: Classical Period.

Weekly, through the year. Associate Professor Vos.

Prose Composition.

C. A. Buchheim, *Materials for German Prose Composition*, Parts I and II, London, 1894.

Weekly, through the year. Professor Wood and Mr. Hofmann.

Private Reading: Schiller, *Wallensteins Tod.*

Elective Course.

Contemporary Literature, in Rapid Readings.

Works by Hauptmann, Sudermann, Ebner-Eschenbach, and von Wildenbruch are read.

Two hours weekly, through the year. Dr. Baker.

This course is intended for students who have completed the equivalent of a Minor.

Special Courses.

Courses 1 and 2 are open to graduate students who already possess an elementary knowledge of German and wish to acquire greater fluency in reading. The first is intended for students in Languages, History, and Economics; the second, for students in the Natural Sciences. Successful completion of either course is accepted as an equivalent of the reading knowledge of German required of candidates for the degree of Doctor of Philosophy.

1. Historical German.

Seiler, *Die Heimat der Indogermanen;* Hoffmann's *Historische Erzählungen;* Lange, *Athen im Spiegel der aristophanischen Komödie.*

Twice weekly. Dr. Baker.

2. Scientific German.

Dippold, *Scientific German Reader;* von Helmholtz, *Über Goethe's naturwissenschaftliche Arbeiten.*

Twice weekly. Dr. Baker.

This course is open to graduate students who already possess an elementary knowledge of German, and wish to acquire greater fluency in reading.

3. Oral Exercises in German.

Twice weekly. Mr. Hofmann.

This course is intended especially for students in the departments of modern languages, who lack an extended vocabulary and sufficient familiarity with written and spoken German. A thorough knowledge of the elements is presupposed.

ROMANCE LANGUAGES.

Advanced Courses.

I. With second and third year students:

Professor Elliott.

(*a*). Seminary. *Twice weekly.*

The Fables of Marie de France; Work on Manuscripts.

(*b*). French Dialects. *Weekly.*

(*c*). Lectures on Dante. *Weekly.*

(*d*). Romance Club. *Weekly.*

Professor F. M. Warren.

(*e*). The Breton Cycle. *Twenty lectures in the month of ruary.*

(*f*). The Mediæval French Drama. *Four lectures.*

(*g*). The Modern French Drama. *Eight public lectures.*

[I. The Theatre of Corneille, Molière, and Racine. II. Vo Work as a Playwright. III. La Chaussée's Innovations. rot's Reform. IV. Shakespeare's Influence. V. The Ro School. Victor Hugo. VI. Dumas, De Vigny, Musset, VII. The *drame*, Dumas *fils*, Sardou. VIII. Symbolism Stage. The Plays of To-day.]

Associate Professor Marden.

(*h*). Spanish Philology. *Twice weekly.*

Gorra, *Lingua e Letteratura Spagnuola delle Origini;* Bai *Spanische Sprache* (in Gröber's *Grundriss der Romanischen logie*); Meyer-Lübke, *Grammaire des Langues Romanes*, vol

(*i*). Old Spanish Readings. *Weekly.*

Gorra, *Lingua e Litteratura Spagnuola delle Origini;* Lidfor *Cantares de Myo Cid;* Janer, *Poetas Castellanos anteriores* *XV.*

(*j*). Spanish Seminary. Poema de Fernan Gonzalez. *weekly.*

(*k*). Lectures on the Early Spanish Drama. *Weekly.*

II. With first year students:

Professor Elliott.

(*a*). Popular Latin. *Weekly.*

(*b*). French Physiological Phonetics. *Weekly.*

Passy, *Les sons du français;* Beyer, *Französiche Phonetik;* *Primer of Phonetics;* Vietor, *Elemente der Phonetik;* Mi and Passy, *Dictionnaire Phonétique de la Langue Française.*

Associate Professor Rambeau.

(*c*). Phonetics and French pronunciation, with practical cises. *Weekly, second half-year.*

A. Rambeau and Jean Passy, *Chrestomathie française*, Holt, York, 1897; Paul Passy, *Les sons du français*, 4th edition,

Dr. Brush.

(*d*). Old French Phonology and Morphology. *Three weekly.*

Schwan-Behrens, *Grammatik des Altfranzösichen;* Suchier, *Le çais et le Provençal;* Suchier, *Altfranzösiche Grammatik;* K *Lateinisch-romanisches Wörterbuch;* Nyrop, *Grammaire his de la langue française.*

(*e*). Elementary Course in Old French Readings. *Week*

Texts: Paris and Jeanroy: *Extraits des Chroniquers frança* Paris: *Extraits de la Chanson de Roland;* Saintsbury: *L ments de Strasbourg*, and *La Cantilène de Sainte Eulalie;* Su *Aucassin u. Nicolete;* Warnke: *Die Lais der Marie de Fr*

Dr. J. C. Ballagh, Associate in History:

1. Classical and Early European History.
Four hours weekly, through the year. For undergraduates.
2. Southern Industrial History.
One hour weekly, through the year. For graduates.
3. Oral Examinations in History.
One hour weekly, through the year. For graduates.
4. National Expansion of the United States.
Six special lectures to graduates and others.

Dr. J. M. Callahan, Albert Shaw Lecturer in American Diplomatic History:

1. America in the Pacific.
Twelve lectures. For graduates.
2. Diplomatic History of the Southern Confederacy.
Twelve lectures. For graduates.

Dr. Guy Carleton Lee, Instructor in History:

1. English Political and Constitutional History.
Two hours weekly, through the year. For undergraduates.
2. History of English Law.
One hour weekly, through the year. For graduates and law students.
3. Parliamentary Law and Practice.
One hour weekly, through the year. For undergraduates.
4. Public Speaking and Class Debates.
Six hours weekly, through the year. For undergraduates.
5. Public Speaking and Lecturing.
One hour weekly, first-half year. For graduates.

Economics.

Associate Professor **Sidney Sherwood**:

1. Economic Conference. Special topic: "The Foreign Commerce and Commercial Policy of the United States."
Two hours weekly, through the year. For graduates.
2. Commerce.
Two hours weekly, first half-year. For graduates.
3. Transportation.
Two hours weekly, second half-year. For graduates.
4. Principles of Economics.
One hour weekly, throughout the year. For graduates.
5. Elements of Economics.
Two hours weekly, first half-year. Required of all undergraduates.
6. Recent Economic Theories.
Two hours weekly, second half-year. For undergraduates; open to graduates.

Associate Professor **J. H. Hollander**.

1. Development of Economic Thought before Adam Smith.
Two hours weekly, first half-year. For graduates.
2. Municipal Finance.
Two hours weekly, second half-year. For graduates.
3. Recent Economic Changes.
Two hours weekly, first half-year. For graduates and undergraduates.
4. History of Economic Thought.
Two hours weekly, first half-year. For undergraduates in Group VI.
5. International Trade and Socialism.
Two hours weekly, second half-year. For undergraduates in Group VI.
6. Money and Taxation.
Two hours weekly, second half-year. Required of all undergraduates.

Politics.

Associate Professor **W. W. Willoughby** will conduct the following courses:

1. History of Ancient Political Philosophy.
Two hours weekly, first half-year. For graduates.
2. History of Mediaeval Political Philosophy.
Two hours weekly, second half-year. For graduates.
3. Comparative Constitutional Law.
Two hours weekly, throughout the year. For graduates.
4. Political Conference.
Fortnightly, throughout the year. For graduates.

Public Aid, Charity, and Correction.

Dr. J. R. Brackett will represent these subjects as foll

1. Class lectures on Charitable and Correctional Legislat
Europe and America.
One hour weekly, through the year. For graduates and specialists.
2. Weekly Conference on Public Aid, Charity, and Correc

PHILOSOPHY.

The undergraduate courses in Philosophy provide five
per week of work for one year, under the direction of Pr
Griffin. All candidates for the degree of Bachelor of A
required to follow them during the last year of residence.

1. Deductive and Inductive Logic.

The logical forms—terms, propositions, syllogisms—are studie
analysis or explanation of the thinking process, and as a practi
cipline in exact thought: attention is given also to the material e
in inference, as these are stated in the several inductive methods.

Jevons's Elementary Lessons in Logic and Fowler's Elements of Ir
Logic are used as text-books, with references to the works of Mil
Keynes, and other writers.

Four hours weekly, until Christmas.

2. Psychology.

The instruction in psychology is intended to give a general view
results of the present methods of study, the investigations in regar
quality and intensity of sensations, the duration of psychic acts,
general, the subjects treated in Part II of Ladd's Physiological Psy
—being presented with sufficient detail to render them intelligil
interesting. A series of lectures and demonstrations on the anato
physiology of the nervous system, by Dr. L. F. Barker, is included
course.

Especial emphasis is laid upon the facts of conscious experi
known through introspection, the most important end to be secured
it is believed, such an understanding of the facts and laws of menta
shall fit one for wise self-government and effective influence. W
view, such powers and states of mind as attention, memory, asso
habit, imagination, the feelings, the will, are discussed in as concr
practical a way as possible. A text-book is used as a basis of inst
but this is largely supplemented by informal lectures, and by refer
various authorities.

Baldwin's Elements of Psychology, Sully's Human Mind,
Psychology, Höffding's Outlines of Psychology, Dewey's Psyc
Hamilton's Lectures on Metaphysics, Porter's Human Intellect, S
Principles of Psychology, Ladd's Physiological Psychology, are
books of reference. One essay on an assigned subject is required fr
member of the class.

Fours hours weekly, during January; five hours, from February 1 *to*

3. Ethics.

Ethics is treated with reference to its fundamental problems as a t
cal science and also from a practical point of view. Its psychologi
in the various forms of feeling native to our constitution, and in th
of rational self-determination; the nature of the sense of obligati
authority of conscience; the diversities of moral opinion; the
theories of morals—hedonism, utilitarianism, intuitionism, and th
cation to ethical theory of the doctrine of evolution;—these are
the topics discussed.

DEGREES CONFERRED JUNE 13, 1899.

The public exercises of Commencement were held in the Academy of Music at 4 p. m., Tuesday, June 13, 1899. Degrees were conferred on thirty-eight bachelors of arts, thirty-eight doctors of philosophy, and thirty-two doctors of medicine, and certificates were given to five proficients in Applied Electricity (see lists below.) The honors of the year and the recent appointments were announced by the President (see page 90 of this *Circular*.) In the evening a reception to the graduates and their friends was given in McCoy Hall.

DOCTORS OF PHILOSOPHY.

THOMAS SEWELL ADAMS, of Baltimore, A. B., Johns Hopkins University, 1896. *Subjects:* Economics, Politics, and History of Philosophy. *Dissertation:* Index Numbers and the Standard of Value. *Referees on dissertation:* Professors Newcomb and Sherwood, and Dr. Hollander.

JOHN WILLIAM BASORE, of Broadway, Va., A. B., Hampden-Sidney College, 1893. *Subjects:* Latin, Greek, and Sanskrit. *Dissertation:* A Study of 'Υπόκρισις in the Commentary of Donatus to the Plays of Terence. *Referees on dissertation:* Professors Warren and Smith.

EDWARD WILLIAM BERGER, of Berea, O., Ph. B., Baldwin University, 1894. *Subjects:* Zoology, Physiology, and Botany. *Dissertation:* The Cubomedusae: Physiological and Histological; with Dr. F. S. Conant's Notes on the Physiology. *Referees on dissertation:* Professors Brooks and Howell.

WILLIAM NOLAND BERKELEY, of Charlottesville, Va., S. B., St. John's College, 1896. *Subjects:* Chemistry, Geology, and Physics. *Dissertation:* An Investigation of the Relative Rate of Reduction of Nitrobenzoic Acids. *Referees on dissertation:* Professors Remsen and Morse.

PIERCE BUTLER, of New Orleans, La., A. B., Tulane University, 1892. *Subjects:* English, French, and History. *Dissertation:* Legenda Aurea—Légende Dorée—Golden Legend: A Study of Caxton's Golden Legend, with special reference to its Relations to the Earlier English Prose Translation. *Referees on dissertation:* Professors Bright and Browne.

HORACE GREELEY BYERS, of Pulaski, Pa., A. B. and S. B., Westminster College (Pa.), 1895. *Subjects:* Chemistry, Physics, and Mathematics. *Dissertation:* A Study of the Reduction of Permanganic Acid by Manganese Dioxide. *Referees on dissertation:* Professors Remsen and Morse.

JOSEPH SCUDDER CHAMBERLAIN, of Hudson, O., S. B., Iowa Agricultural College, 1890. *Subjects:* Chemistry, Biology, and Geology. *Dissertation:* A Further Study of two of the Products of Transformation of Parasulphaminebenzoic Acid when heated to 220°. *Referees on dissertation:* Professors Remsen and Morse.

FRANCIS WHITTEMORE CRAGIN, of Colorado Springs, Colo., S. B., Harvard University, 1882. *Subjects:* Geology, Mineralogy, and Zoology. *Dissertation:* The Paleontology of the Malone Jurassic Formation of Texas. *Referees on dissertation:* Professor Clark and Dr. Matthews.

GEORGE VAIL EDWARDS, of Riverhead, N. Y., A. B., Hamilton College, 1891. *Subjects:* Latin, Sanskrit, and Greek. *Dissertation:* The Ablative and Genitive of Quality. *Referees on dissertation:* Professors Warren and Smith.

OLIVER LANARD FASSIG, of Baltimore, S. B., Ohio State University, 1882. *Subjects:* Geology, Physics, and Petrography. *Dissertation:* March Weather in the United States, with special reference to the Middle Atlantic States: A Study of the Relations existing between Mean Atmospheric Pressure and the General Characteristics of the Weather and Storms in March. *Referees on dissertation:* Professors Clark and Abbe.

GEORGE STRONACH FRAPS, of Raleigh, N. C., S. B., North Carolina Agricultural College, 1896. *Subjects:* Chemistry, Physics, and Geology. *Dissertation:* The Composition of a Wood Oil. *Referees on dissertation:* Professors Remsen and Morse.

PIERRE JOSEPH FREIN, of Great Barrington, Mass., A. B., Williams College, 1892. *Subjects:* French, Italian, and History. *Dissertation:* Phonology of the Patois of Pleigne (Canton de Berne). *Referees on dissertation:* Professor Elliott and Dr. Armstrong.

LEONIDAS CHALMERS GLENN, of Crowder's Creek, N. C., A. B., University of South Carolina, 1891. *Subjects:* Geology, Mineralogy, and Biology. *Dissertation:* A Contribution to the Study of the Pelecypoda of the Miocene of Maryland. *Referees on dissertation:* Professors Clark and Reid.

CASWELL GRAVE, of Monrovia, Ind., S. B., Earlham College, 1895. *Subjects:* Zoology, Botany, and Physiology. *Dissertation:* Ophiura Brevispina, Say. *Referees on dissertation:* Professors Brooks and Andrews.

NATHANIEL EDWARD GRIFFIN, of Baltimore, A. B., Johns Hopkins University, 1894. *Subjects:* English, German, and History of Philosophy. *Dissertation:* A Study of the Middle English "Sege of Troye." *Referees on dissertation:* Professors Bright and Browne.

KARL JOSEF GRIMM, of Baltimore. *Subjects:* Biblical Philology, Assyrian, and History of Philosophy. *Dissertation:* Euphemistic Liturgical Appendixes in the Old Testament. *Referees on dissertation:* Professor Haupt and Professor George F. Moore, of Andover, Mass.

HOLLISTER ADELBERT HAMILTON, of Rochester, N. Y., A. B., University of Rochester, 1892. *Subjects:* Greek, Latin, and Sanskrit. *Dissertation:* The Negative Compounds in Greek. *Referees on dissertation:* Professors Gildersleeve and Spieker.

WILLIS BOIT HOLMES, of Cambridge, Mass., A. B., Harvard University, 1896. *Subjects:* Chemistry, Geology, and Mineralogy. *Dissertation:* A Further Investigation of the Chlorides of Orthosulphobenzoic Acid and Paranitroorthosulphobenzoic Acid. *Referees on dissertation:* Professors Remsen and Morse

GEORGE OSCAR JAMES, of Bowers Hill, Va., A. B., Johns Hopkins University, 1895. *Subjects:* Mathematics, Physics, and Astronomy. *Dissertation:* On the Differential Equations connected with Hypersurfaces. *Referees on dissertation:* Professors Newcomb and Craig.

JAMES WILLIAM KERN, of Alexandria, Va., University of Va., 1881. *Subjects:* Greek, Sanskrit, and Latin. *Dissertation:* 'Ανά and Κατά in Composition and with Case. *Referees on dissertation:* Professors Gildersleeve and Miller.

WILLIAM KURRELMEYER, of Baltimore, A. B., Johns Hopkins University, 1896. *Subjects:* German, French, and Sanskrit. *Dissertation:* The Historical Development of the Types of the First Person Plural Imperative in German. *Referees on dissertation:* Professors Wood and Vos.

ALVIN FAYETTE LEWIS, of Bowling Green, Ky., A. B., Princeton University, 1884. *Subjects:* History, Economics, and the History of Philosophy. *Dissertation:* A History of Education in Kentucky. *Referees on dissertation:* Professors Adams and Vincent.

JOSEPH FRANCIS MERRILL, of Richmond, Utah, S. B., University of Michigan, 1893. *Subjects:* Physics, Electricity, and Mathematics. *Dissertation:* Influence of the Surrounding Dielectric on the Conductivity of Copper Wires. *Referees on dissertation:* Professors Rowland and Ames.

ALFRED WILLIAM MILDEN, of Cornwall, Ont., A. B., University of Toronto, 1888. *Subjects:* Greek, Latin, and Sanskrit. *Dissertation:* Phases of Oblique Predication in Greek. *Referees on dissertation:* Professors Gildersleeve and Miller.

DANIEL ESTEN MOTLEY, of Chatham, Va., A. B., Milligan College (Tenn.), 1894. *Subjects:* History, Economics, and History of Philosophy. *Dissertation:* Life of Commissary James Blair, William and Mary College. *Referees on dissertation:* Professor Adams and Dr. Ballagh.

ROKURO NAKASEKO, of Kyoto, Japan, Doshisha University, 1889. *Subjects:* Chemistry, Physiology, and Biology. *Dissertation:* Some Transformations of Metasulphaminebenzoic Acid under the Influence of Heat. *Referees on dissertation:* Professors Remsen and Morse.

WILLIAM ALBERT NITZE, of Baltimore, A. B., Johns Hopkins University, 1894. *Subjects:* French, Italian, and German. *Dissertation:* A Study of the Perlesvaus. *Referees on dissertation:* Professor Elliott and Dr. F. M. Warren.

FREDERICK ALBERT SAUNDERS, of Ottawa, Canada, A. B., University of Toronto, 1895. *Subjects:* Physics, Mathematics, and Astronomy. *Dissertation:* A Bolometric Study of the Spectrum of an Absolutely Black Body between the Temperatures of 100° and 578° Centigrade. *Referees on dissertation:* Professors Rowland and Ames.

LAURENCE FREDERICK SCHMECKEBIER, of Baltimore, A. B., Johns Hopkins University, 1896. *Subjects:* History, Economics, and Politics. *Dissertation:* History of the Know-Nothing Party in Maryland. *Referees on dissertation:* Professor Adams and Dr. Steiner.

ST. GEORGE LEAKIN SIOUSSAT, of Lake Roland, Md., A. B., Johns Hopkins University, 1896. *Subjects:* History, Politics, and Economics. *Dissertation:* History of Highway Legislation in Maryland, and its Influence o

RECENT APPOINTMENTS AND HONORS, ANNOUNCED JUNE 13, 1899.

The following promotions and appointments have recently been made by the Trustees:—

In the Philosophical Faculty:

Jacob H. Hollander, Ph. D., now Associate, to be Associate Professor of Finance.

Christopher Johnston, Ph. D., now Associate, to be Associate Professor of Oriental History and Archæology.

C. Carroll Marden, Ph. D., now Associate, to be Associate Professor of Romance Languages.

Edward B. Mathews, Ph. D., now Associate, to be Associate Professor of Mineralogy.

Westel W. Willoughby, Ph. D., now Associate, to be Associate Professor of Politics.

Edward C. Armstrong, Ph. D., now Instructor, to be Associate in Romance Languages.

N. Ernest Dorsey, Ph. D., now Assistant, to be Associate in Physics.

Duncan S. Johnson, Ph. D., now Assistant, to be Associate in Botany.

Philip Ogden, Ph. D., now Instructor, to be Associate in Romance Languages.

George B. Shattuck, Ph. D., now Instructor, to be Associate in Physiographic Geology.

Murray P. Brush, Ph. D., to be Instructor in Romance Languages.

William B. Huff, A. M., to be Assistant in Physics.

William M. Mackdermott, to be Instructor in Physical Culture.

Morris C. Sutphen, Ph. D., to be Instructor in Latin.

Henry S. West, Ph. D., to be Assistant in English.

James M. Callahan, Ph. D., to be Albert Shaw Lecturer on American Diplomatic History, in 1899–1900.

L. A. Bauer, Ph. D., to be Lecturer in Terrestrial Magnetism.

In the Medical Faculty:

J. Whitridge Williams, M. D., now Associate Professor, to be Professor of Obstetrics.

Lewellys F. Barker, M. B., now Associate Professor of Anatomy, to be Associate Professor of Pathology.

Ross G. Harrison, Ph. D., now Associate, to be Associate Professor of Anatomy.

Charles R. Bardeen, M. D., now Assistant, to be Associate in Anatomy.

Harvey W. Cushing, M. D., now Assistant, to be Associate in Surgery.

George W. Dobbin, M. D., now Assistant, to be Associate in Obstetrics.

Walter Jones, Ph. D., now Assistant, to be Associate in Physiological Chemistry and Toxicology.

P. M. Dawson, M. D., to be Assistant in Physiology.

Eugene L. Opie, M. D., to be Second Assistant in Pathology.

Mervin T. Sudler, Ph. D., to be Assistant in Anatomy.

JOHN MARSHALL PRIZE.

The John Marshall Prize for 1899 has been awarded to **Jacob H. Hollander**, Ph. D., Associate Professor of Finance, for his publication entitled "The Financial History of Baltimore."

ADAM T. BRUCE FELLOW.

Caswell Grave, of Monrovia, Ind., S. B., Earlham College, 1895, Ph. D., Johns Hopkins University, 1899, and late Fellow in Zoology.

FELLOWS.

George Ernest Barnett, of Mocksville, N. C., A. B., Randolph College, 1891. *Economics.*

Frank Ringgold Blake, of Baltimore, A. B., Johns Hopkins U sity, 1897. *Semitic Languages.*

William Martin Blanchard, of Hertford, N. C., A. B., Ra Macon College, 1894. *Chemistry.*

* **Charles Edward Caspari**, of Baltimore, A. B., Johns Hopki versity, 1896. *Chemistry.*

Luther Pfahler Eisenhart, of York, Pa., A. B., Pennsylvani lege, 1896. *Mathematics.*

Herbert Baldwin Foster, of Baltimore, A. B., Harvard Univ 1895. *Greek.*

William Linwood Foushee, of Roxboro, N. C., A. M., Wake College, 1894. *Greek.*

Clyde Chew Glascock, of Buckland, Va., University of Vi 1892. *German.*

Lawrence Edmonds Griffin, of Hamline, Minn., A. B. and Hamline University, 1895. *Zoology.*

Sivert N. Hagen, of Hagan, Minn., A. B., Luther College, *English.*

Joseph Cawdell Herrick, of Virginia, A. B., University of Vi 1896. *Physiology.*

Julian Huguenin, of Charleston, S. C., A. B., Charleston College *English.*

Walter Hullihen, of Staunton, Va., A. B. and A. M., Unive Virginia, 1896. *Latin.*

Charles A. Kraus, of Lawrence, Kan., S. B., University of 1898. *Physics.*

Harry Taylor Marshall, of Baltimore, A. B., Johns Hopki versity, 1894, and M. D., 1898. *Pathology.*

John Charles Olsen, of Galesburg, Ill., A. B., Knox College *Chemistry.*

Herbert Meredith Reese, of Baltimore, A. B., Johns Hopki versity, 1897. *Physics.*

George Burr Richardson, of New York City, S. B., Harvard U sity, 1895. *Geology.*

Richard Burton Rowe, of Clarksville, N. Y., Ph. B., Union 1896. *Geology.*

James Eustace Shaw, of Florence, Italy, A. B., Johns Hopki versity, 1896. *Romance Languages.*

Charles Clinton Weaver, of Greensboro, N. C., A. B., Trini lege (N. C.), 1895. *History.*

* Resigned.

HOPKINS SCHOLARSHIPS.

OFFERED TO VIRGINIA AND NORTH CAROLINA STUDEN

These scholarships, in accordance with the wishes of the found awarded to candidates from Virginia and North Carolina who ar sidered by the Academic Council to be the "most deserving of because of their character and intellectual promise." They are a to college graduates; the Maryland Scholarships, elsewhere announc given to undergraduates:—

Honorary Scholarships:

I. H. Blackwell (A. B., Randolph Macon, 1895), of Broadrun, V
W. S. Drewry (A. B., University of Virginia, 1893), of Fayetteville,
R. E. Humphreys (A. B., Emory and Henry College, 18[illegible]), of Salem,
Carl Kinsley (A. B., Oberlin College, 1893), of Falls Church, Va.
A. W. McWhorter (A. B., Roanoke College, 1895), of Salem, Va.
W. S. Myers (A. B., Univ. of North Carolina, 1897), of Asheville, N.
D. P. Parham (A. M., Randolph Macon College, 1891), of Hampton,
G. W. Russell (A. B., Randolph Macon College, 1892), of Onancock,
J. B. Wharey (A. B., Davidson College, 1892), of Moore[illegible], N. C.
W. C. Wicker (A. B., Univ. of N. C., 1895), of Elon Co[illegible] N. C.

The Johns Hopkins Press.

LIST OF SERIAL PUBLICATIONS.

American Journal of Mathematics.

This journal was commenced in 1878, under the editorial direction of Professor Sylvester. Professor Simon Newcomb is now the Editor. Twenty volumes of about 400 pages each have been issued, and the twenty-first is in progress. It appears quarterly. Subscription $5 per year. Single numbers $1.50.

A very few complete sets remain. These will be sold for $100 per set.

American Chemical Journal.

This journal was commenced in 1879, with Professor Remsen as Editor. Twenty volumes of about 450 pages each have been issued, and the twenty-first is in progress. Beginning with 1899, this journal will appear monthly. Two volumes of six numbers and of about 500 pages each will be issued yearly. Subscription $5 per year. Single numbers 50 cents.

American Journal of Philology.

The publication of this journal commenced in 1889, under the editorial direction of Professor Gildersleeve. Nineteen volumes of about 570 pages each have been issued, and the twentieth is in progress. It appears four times yearly. Subscription $3 per volume. Single numbers $1. Only a few sets remain in the hands of the editor. Price will be stated on application.

Studies from the Biological Laboratory.

(*Including the Chesapeake Zoölogical Laboratory.*)

The publication of these papers commenced in 1879, under the direction of Professor Martin, with the assistance of Professor W. K. Brooks. Five volumes of about 500 pages, octavo, and 40 plates each, have been issued.

Studies in Historical and Political Science.

The publication of these papers was begun in 1882, under the editorial direction of Professor H. B. Adams. Sixteen series are now completed and the seventeenth series is in progress. It appears monthly. Subscription $3 per volume. A set of sixteen series, in cloth, will be sold for $48. Twenty extra volumes have also been issued.

A detailed list of these Studies will be sent on application.

Memoirs from the Biological Laboratory.

These monographs are issued under the editorial direction of Professor W. K. Brooks. Volume IV is in progress. Price of the first three volumes $25.

Johns Hopkins University Circulars.

The publication of these Circulars began in December, 1879, and 140 numbers have since been issued. Subscription $1.00 per year.

Contributions to Assyriology and Comparative Semitic Philology.

The publication of this journal was begun in 1889. Professor Paul Haupt, of the Johns Hopkins University, and Professor Friedrich Delitzsch, of the University of Breslau, are the editors. Volume IV is in progress.

The Johns Hopkins Hospital Reports.

These reports are edited by the Faculty of the Johns Hopkins Medical School and published for the Johns Hopkins Hospital. Their publication was begun in 1890. Volume VII is in progress. Price $5 per volume.

The set of seven volumes will be sold for $35.

The Johns Hopkins Hospital Bulletin.

The publication of these Bulletins began in 1889. Volu
progress. They are published monthly. Subscription $1.00 pe
set of ten volumes will be sold for $20.

Modern Language Notes.

This journal is edited by Professor A. M. Elliott and his asso
Modern Language Department. It appears monthly. The
volume is in progress. Subscription $1.50 per year.

The Journal of Experimental Medicine.

This journal is edited by Professor W. H. Welch with the co
a number of associates. It appears six times a year. Volu
progress. Subscription $5.00 per year.

The set of four volumes will be sold for $25.

American Journal of Insanity.

This journal is under the direction of Professor Henry M. Hu
in-chief. It appears quarterly. Volume LV is in progress.
$5.00 per year.

Reports of the Maryland Geological Survey.

These reports are under the editorial direction of Professor
Director of the Survey.

Terrestrial Magnetism and Atmospheric Electric

This journal is under the direction of Dr. L. A. Bauer.
quarterly. Volume IV is now in progress. Subscription $2.

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are:—

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the University. Now in progress.

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BALTIMORE, MD.

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Recent Appointments and Honors, -

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Applied Electricity: Mr. Whitehead. Thursday and Friday, 12 m., Room 24. (8).

Ewell, A. W.
Kent, N. A.
Lucke, H. J.
Meyer, J. F.
Parsons, L. A.
Pender, H.
Potts, L. M.
Reese, H. M.

Laboratory Work: Professor Rowland, Professor Ames, Dr. Bliss, Dr. Dorsey, Mr. Whitehead. Daily, 9 a. m. to 5 p. m. (78).

Baetjer, H.
Barrett, J. T.
Beasley, E. B.
Beeuwkes, H.
Bernheim, E. P.
Bird, R. M.
Brown, J. R. C.
Bruton, A. W.
Buttner, W. J.
Bye, M.
Caldwell, B. P.
Campbell, J. G.
Converse, H. A.
Cronin, T. H.
Crum, C. W. R.
Dapprich, F. R.
Edmunds, C. K.
Evans, J. R.
Ewell, A. W.
Foster, F.
Gilbert, N. E.
Hazen, H. H.
Hill, H. D.
Hoffman, W. E.
Hoge, J. F. D.
Huff, W. B.
Hun, J. G.
Hyde, E. P.
James, G. O.
Kent, N. A.
King, J. H.
Kirby, F. J.
Knapp, A. M.
Kraus, C. A.
Lindsay, C. F.
Lisberger, S J.
Love, J. M.
Loving, R. E.
Lucke, H. J.
Macht, D I.
McGlone, B.
Meyer, J. F.
Middlekauff, G. W.
Miller, H. C.
Moore, J. H.
Moore, R. E.
Morse, R. B.
Mower, F. D.
Murphy, L. C.
Parsons, L. A.
Pels, I. R.
Pender, H.
Pierce, E. D.
Pinkerton, T. C.
Potts, L. M.
Putts, B. S.
Rabinovitch, I. E.
Reese, H. M.
Robertson, C. B.
Routh, J. E.
Schenck, C. C.
Schultz, C. H.
Shippen, L. P.
Slemons, J. A.
Smith, A. W.
Sneeringer, W. J.
Stein, J. S.
Stone, H. B.
Strouse, S.
Tondorf, F. A.
Turner, A. B.
Warner, H. M.
Watkins, R. H.
Whitehead, R. F.
Whitehill, I. E.
Wolf, M. W.
Wolman, S.
Wroth, P.

Experimental Physics for Medical Students: Mr. Huff. Saturday, 9 a. m. to 12 m. (6).

Bixler, L. C.
Gaines, L. M.
Lynch, L. A.
Schultz, O. T.
Smith, W. H.
Travis, C. H.

Chemistry. (114 Students).

Classes meet in the Chemical Laboratory, except as otherwise stated.

Organic Chemistry: (*For Graduate Students*): Professor Remsen. Daily, except Monday, 9 a. m. (31).

Beck, G. C.
Bird, R. M.
Black, H. V.
Blanchard, W. M.
Caldwell, B. P.
Canter, H.
Carter, J. D.
Case, W. A.
Caspari, C. E.
Chambliss, H.
Chambers, V. J.
Clark, F. E.
Douglas, J. M.
Flinn, F. B.
Frazer, J. C. W.
Garner, W. W.
Hancock, F. A.
Harris, C. D.
Horn, D. W.
Humphreys, R. E.
King, S. H.
Lindsay, C. F.
Olsen, J. C.
Patterson, A. M.
Robertson, C. B.
Russell, G. W.
Schultz, C. H.
Simmons, W. W.
Taveau, R. de M.
Torrey, C. A.
Yamaguchi, K.

Journal Meeting: Professor Remsen. Monday, 9 a. m. (32). The instructors in Chemistry and the following students:

Beck, G. C.
Bird, R. M.
Black, H. V.
Blanchard, W. M.
Caldwell, B. P.
Canter, H.
Carter, J. D.
Case, W. A.
Caspari, C. E.
Chambers, V. J.
Chambliss, H.
Clark, F. E.
Douglas, J M.
Flinn, F. B.
Frazer, J. C. W.
Garner, W. W.
Hancock, F. A.
Harris, C. D.
Horn, D. W.
Humphreys, R. E.
King, S. H.
Kraus, C. A.
Lindsay, C. F.
Olsen, J. C.
Patterson, A. M.
Robertson, C. B.
Russell, G. W.
Schultz, C. H.
Simmons, W. W.
Taveau, R. de M.
Torrey, C. A.
Yamaguchi, K.

Physical Chemistry: Dr. H. C. Jones. Monday, Tuesday, Wednesday, 12 m. (10).

Caldwell, B. P.
Chambers, V. J.
Clark, F. E.
Edmunds, C. K.
Frazer, J. C.
Hall, E. S.
King, S. H.
Olsen, J. C.
Smith, A. W.
Torrey, C. A.

Elements of Physical Chemistry: Dr. H. C. Jones. Thursday and Friday, 12 m. (14)

Black, H. V.
Blanchard, W. M.
Canter, H.
Case, W. A.
Chambliss, H.
Douglas, J. M.
Garner, W. W.
Horn, D. W.
Humphreys, R. E.
King, S. H.
Patterson, A. M.
Robertson, C. B.
Simmons, W. W.
Yamaguchi, K.

Inorganic Chemistry: (*Major Course*): Professor Morse. Daily, except Monday, 9 a. m. (24).

Abercrombie, R. T.
Brooks, C. E.
Bye, M.
Constantine, C. W.
Dapprich, F. R.
Hatch, E. C.
James, W. McC.
Leopold, E. J.
Mackall, L. L.
Mower, F. D.
Neal, W. D.
Porter, G. F.
Rehberger, G. E.
Rehberger, J. M.
Riggins, J. A.
Schaun, P. E.
Shipley, S. D.
Shippen, L. P.
Shreve, O. F.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Washington, F. J.
West, A. P.

General Chemistry: (*Minor Course*): Professor Renouf and Dr. Gilpin. Daily, except Monday, 9 a. m., Hopkins Hall. (55).

Barrett, J. T.
Beasley, E. B.
Beeuwkes, H.
Bernheim, B. M.
Bernheim, E. P.
Bird, A. R.
Boyer, N.
Brown, E. B.
Brown, J. R. C.
Buttner, W. J.
Byrne, H. S.
Campbell, J. G.
Clark, C. T.
Crane, R. T.
Fishach, L. G.
Gillespie, H. C.
Hall, E. S.
Hazen, H. H.
Hill, E. C.
Hoffman, W. E.
Hoge, J. F. D.
Hollander, L. M.
Hutzler, L. S.
Keller, J. F.
Kenney, W. C.
King, J. H.
Koppelman, W. H.
Lindheim, N. R.
Love, J. M.
Macht, D. I.
McGlone, B.
Moore, R. E.
Murphy, L. C.
Pels, I. R.
Pinkerton, T. C.
Powers, H. W. S.
Putts, B. S.
Remsen, C. M.
Reynolds, W. F.
Sayler, J. A.
Schermerhorn, A. V. R.
Sisco, G. E.
Slemons, J. A.
Snavely, G. E.
Stone, H. B.
Strouse, S.
Turnbull, B.
Tyler, J. E.
Vickers, H. W.
Watkins, R. H.
Whitehead, R. F.
Whitehill, I. E.
Whitman, H. S.
Wolman, S.
Wroth, P.

Laboratory Work: Professor Remsen, Professor Morse, Pro Renouf, Dr. Gilpin, Dr. H. C. Jones, and Assistants. Daily, to 5 p. m. (113).

Abercrombie, R. T.
Barrett, J. T.
Beasley, E. B.
Beck, G. C.
Beeuwkes, H.
Bernheim, B. M.
Bernheim, E. P.
Bird, A. R.
Bird, R. M.
Black. H. V.
Blanchard, W. M.
Boyer, N.
Brooks, C. E.
Brown, E. B.
Brown, J. R. C.
Buttner, W. J.
Bye, M.
Byrne, H. S.
Caldwell, B. P.
Campbell, J. G.
Canter, H.
Carter, J. D.
Case, W. A.
Caspari, C. E.
Chambers, V. J.
Chambliss, H.
Clark, C. T.
Clark, F. E.
Constantine, C. W.
Crane, R. T.
Dapprich, F. R.
Douglas, J. M.
Edmunds, C. K.
Fishach, L. G.
Flinn, F. B.
Frazer, J. C. W.
Garner, W. W.
Gillespie, H. C.
Hall, E. S.
Hancock, F. A.
Harris, C. D.
Hatch, E. C.
Hazen, H. H.
Hill, E. C.
Hoffman, W. E.
Hoge, J. F. D.
Hollander, L. M.
Horn, D. W.
Humphreys, R. E.
Hutzler, L. S.
James, W. McC.
Keller, J. F.
Kenney, W. C.
King, J. H.
King, S. H.
Koppelman, W. H.
Leopold, E. J.
Lindheim, N. R.
Lindsay, C. F.
Love, J. M.
Macht, D. I.
Mackall, L. L.
McGlone, B.
Moore, R. E.
Mower, F. D.
Murphy, L. C.
Neal, W. D.
Olsen, J. C.
Patterson, A. M.
Pels, I. R.
Pinkerton, T. C.
Porter, G. F.
Powers, H. W. S.
Putts, B. S.
Rehberger, G. E.
Rehberger, J. M.
Remsen, C. M.
Reynolds, W. F.
Riggins, J. A.
Robertson, C. B.
Russell, G. W.
Sayler, J. A.
Schaun, P. E.
Schermerhorn, A. V. R.
Schultz C. H.
Shipley, S.
Shippen, L
Shreve, O.
Simmons,
Sisco, G. E.
Slemons, J.
Smith, A.
Snavely, G.
Spencer, L.
Stone, H.
Straus, H.
Strouse, S.
Struth, O.
Swindell,
Taveau, R.
Torrey, C.
Turnbull,
Tyler, J. E
Vickers, H
Washingto
Watkins,
West, A. P.
Whitehead
Whitehill,
Whitman,
Wolman, S.
Wroth, P.
Yamaguchi

Geology. (31 Students).

Classes meet in the Geological Laboratory.

Historical Geology: Professor Clark. Tuesday and Wedn 9 a. m. (8).

Bonsteel, J. A.
Hindshaw, H. H.
Martin, G. C.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Rowe, R. B
Wright, F.

Paleontology: (*Laboratory Work*): Professor Clark and Dr. tuck. Daily. (8).

Bonsteel, J. A.
Duerden, J. E.
Martin, G. C.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Rowe, R. B
Wright, F.

General Geology: (*Minor Geology*): Dr. Shattuck. Daily, e Friday, 1 p m. (19).

Baldauf, L. K.
Beck, G. C.
Bird, A. R.
Bonsteel, J. A.
Hall, E. S.
Harris, C. D.
Kerr, R. C.
Mackall, L L.
Martin, G. C.
Neal, W. D.
Porter, G. F.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Shipley, S. D.
Simmons, W
West, A. P.
Wolf, M. W.
Wright, F.

Geological Physics: Associate Professor Reid. Monday and T day, 9 a. m. (10).

Bonsteel, J. A.
Kent, N. A.
Neal, W. D.
Martin, G. C.
Parsons, L. A.
Pender, H.
Richardson, G. B.
Romine, A. P.
Tondorf, F.
Wright, F. B

Advanced Mineralogy: Associate Professor Mathews. Mon Wednesday, and Friday, 11 a. m. (7).

Bonsteel, J. A.
Martin, G. C.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Wright, F. B.

General Mineralogy: (*Major Geology*): Associate Profe Mathews. Daily, except Thursday, 12 m. (9).

Bonsteel, J. A.
Carter, J. D.
Eckenrode, H. J.
Flinn, F. B.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Taveau, R. de
Wright, A.

Physiographic Geology: Dr. Shattuck. Tuesday, 10 a. m.

Bonsteel, J. A.
Martin, G. C.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Wright, F. B.

Journal Meeting: Professor Clark. Tuesday, 11 a. m. (13).

Bibbins, A.
Bonsteel, J. A.
Fassig, O. L.
Hindshaw, H. H.
Martin, G. C.
Mathews, E. B.
Neal, W. D.
Reid, H. F.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Shattuck, G. B.
Wright, F. B.

Biology. (104 Students).

Advanced Zoology: Professor Brooks. Daily, Biological Labo tory. (9).

Curtis, W. C.
Duerden, J. E.
Eyster, J. A. E.
Grave, C.
Griffin, L. E.
Perkins, H. F.
Reese, A. M.
Shoemaker, D.
Stiles, P. G.

Zoological and Botanical Journal Club: Professor Broo Associate Professor Andrews, Dr. D. S. Johnson. Friday, 11 a. Biological Laboratory. (14).

Barton, B. W.
Coker, W. C.
Curtis, W. C.
Drew, G. A.
Duerden, J. E.
Eyster, J. A. E.
Grave, C.
Griffin, L. E.
Metcalf, M. M.
Perkins, H. F.
Reese, A. M.
Shoemaker, D.
Stiles, P. G.
Woodruff, E. S

Zoology: (*Major Biology*): Professor Brooks and Dr. D. S. John Daily, except Monday, 9 a. m., Monday and Tuesday, 2–5 p. m., B logical Laboratory. (8).

Breed, A. A.
Eyster, J. A. E.
Glaser, O. C.
Perkins, H. F.
Rous, F. P.
Shoemaker, D. N.
Stiles, P. G.
Woodruff, E. S

Catullus; Tibullus; Propertius: (*Major Course*): Dr. WILSON. Wednesday, Thursday, and Friday, 10 a. m., Room 10. (8).

Briscoe, J. S.
Chambers, L. M.
Fishach, L. G.
Machen, J. G.
Noble, E. R.
Powers, H. W. S.
Snavely, G. E.
Spencer, L. C.

Roman Literature: (*Minor Course*): Associate Professor SMITH. Tuesday, 9 a. m., Room 11. (15).

Baker, H. R.
Bandel, B. B.
Barnett, E.
Cook, T. G.
Diggs, R. M.
Guggenheimer, F. L.
Kirk, W.
Marbury, O.
Markell, C.
Pearre, A.
Ranft, C. F.
Schmeisser, W. C.
Sharretts, R. C.
Smith, S.
Strouse, E.

Livy: (*Minor Course*): Dr. SUTPHEN. Wednesday, Thursday, and Friday, 9 a. m., Room 12. (25).

Baker, H. R.
Bandel, B. B.
Barnett, E.
Dew, A. G.
Diggs, R. M.
England, J. T.
Guggenheimer, F. L.
Hand, J. P.
Heald, H. B.
Hildebrandt, L. F.
Kirk, W.
Marbury, O.
Markell, C.
Mason, S. T.
Miller, H. C.
Mower, McH.
Myers, C. A.
Ogle, M. B.
Pearre, A.
Ranft, C. F.
Reider, C.
Schmeisser, W. C.
Sharretts, R. C.
Smith, S.
Strouse, E.

Cicero: de Senectute; Prose Composition: Dr. SUTPHEN. Wednesday, Thursday, and Friday, 10 a. m., Room 8. (4).

Hildt, J. C.
Hoffman, R. C.
Lowndes, C. H. G.
White, L. J.

Prose Composition:

Major Course: Dr. WILSON. Monday, 10 a. m., Room 10. (9).

Briscoe, J. S.
Chambers, L. M.
Fishach, L. G.
Machen, J. G.
Mulford, R. J.
Noble, E. R.
Powers, H. W. S
Snavely, G. E.
Spencer, L. C.

Minor Course: Dr. SUTPHEN. Tuesday, 9 a. m., Room 12. (11).

Dew, A. G.
England, J. T.
Hand, J. P.
Heald, H. B.
Hildebrandt, L. F.
Mason, S. T.
Miller, H. C.
Mower, McH.
Myers, C. A.
Ogle, M. B.
Reider, C.

Sanskrit and Comparative Philology. (36 Students).

Classes meet in McCoy Hall, Room 19.

Comparative Philology: Professor BLOOMFIELD. Monday, 4 p. m. (22).

Anderson, R. B. T.
Austin, F. M.
Burrell, J. L. A.
Drenford, G.
Drewry, W. S.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Groome, P. L.
Hill, H. D.
Kern, J. W.
Martin, W. E.
Myers, W. S.
Nininger, M. L.
Purcell, T. N. D.
Raney, L.
Roulston, R. B.
Schneider, J. P.
Stephens, J. C.
Turnbull, B.
Visvanath, S. J.
Weaver, C. C.

Comparative Grammar of Indo-European Consonants: Professor BLOOMFIELD. Friday, 4 p. m. (15).

Archibald, H. T.
Austin, F. M.
Blackwell, I. H.
Drenford, G.
Ewing, A. H.
Foster, H. B.
Guernsey, R.
Lyon, C. E.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.
Visvanath, J. S.

Vedic Seminary: *The Atharva-Veda:* Professor BLOOMFIELD. Thursday, 12 m. (7).

Blake, F. R.
Drenford, G.
Ewing, A. H.
Foster, H. B.
Kern, J. W.
Kurrelmeyer, H.
Ness, J. A.

The Chāndogya-Upaniṣad: Professor BLOOMFIELD. Tuesday, 12 m. (6).

Blake, F. R.
Drenford, G.
Ewing, A. H.
Foster, H. B.
Kern, J. W.
Ness, J. A.

Advanced Sanskrit: *Hitopadeça; Manu:* Professor BLOOMFIELD. Monday and Friday, 12 m. (8).

Archibald, H. T.
Blackwell, I. H.
Drenford, G.
Ewing, A. H.
Guernsey, R.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Elementary Sanskrit: *Whitney's Grammar; Lanman's Reader:* Professor BLOOMFIELD. Tuesday and Thursday, 4 p. m. (6).

Drenford, G.
Edwards, P. H.
Nininger, M. L.
Raney, L.
Spilman, E. A.
Visvanath, S. J.

Oriental Seminary. (29 Students).

Classes meet in the Dillmann Library, McCoy Hall, Room 18.

The Literature of the Old Testament: Professor HAUPT. Friday, 5 p. m. (12).

Arnold, B. W.
Bird, R. M.
Blake, F. R.
Ember, A.
Foote, T. C.
Grimm, K. J.
Groome, P. L.
Hollander, L. M.
Martin, W. E.
Richardson, G. B.
Shoemaker, D. N.
Wolman, S.

History of Israel: Dr. JOHNSTON. Tuesday, 4 p. m. (15).

Blake, F. R.
Bouchelle, B. N.
Brady, J. H.
Burrell, J. L. A.
Caldwell, W.
DeGrange, M.
Ewell, J. E.
Foote, T. C.
Groome, P. L.
Litsinger, W. H.
Martin, W. E.
McPherson, W. B.
Myers, W. S.
Roulston, R. B.
Wicker, W. C.

Elementary Hebrew: Professor HAUPT and Mr. BLAKE. Monday, 2–4 p. m. (8).

Anderson, R. B. T.
Ember, A.
Ewell, J. E.
Litsinger, W. H.
Manken, H.
Roulston, R. B.
Schneider, J. P.
Wicker, W. C.

Hebrew Grammar: Dr. GRIMM. Monday, 4 p. m. (4).

Blake, F. R.
Foote, T. C.
Guttmacher, A.
Wicker, W. C.

Hebrew at Sight: Dr. JOHNSTON. Tuesday, 10 a. m. (5).

Blake, F. R.
Ember, A.
Foote, T. C.
McPherson, W. B,
Wicker,

Hebrew Prose Composition: Professor HAUPT Wed
p. m. (6).

Blake, F. R.
Ember, A.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.
Wicker,

Old Testament Seminary: *Deutero-Isaiah:* Professor
Tuesday, 2–4 p. m. (7).

Blake, F. R.
Caldwell, W.
Ember, A.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.
Wicker,

Post-Biblical Hebrew: *Mishnah and Talmud:* Mr.
Friday, 2–4 p. m. (2).

Blake, F. R.
Grimm, K. J.

Syriac: Dr. JOHNSTON. Friday, 10 a. m. (2).

Blake, F. R.
McPherson, W. B.

Ethiopic: (*Second Year*): Professor HAUPT. Friday, 4 p. m.

Blake, F. R.
Foote, T. C.
Grimm, K. J.

Elementary Arabic: Dr. JOHNSTON. Tuesday, 9 a. m. (

Dennis, J. T.
Foote, T. C.
Wicker, W. C.

Arabic at Sight: Dr. JOHNSTON. Friday, 11 a. m. (5).

Blake, F. R.
Caldwell, W.
Ewing, A. H.
Grimm, K. J.
McPhe

Arabic Prose Composition: Professor HAUPT. Wed
p. m. (6).

Blake, F. R.
Ewing, A. H.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.
Wicker

Assyrian: (*Second Year*): Dr. JOHNSTON. Wednesday an
12 m. (3).

Blake, F. R.
Foote, T. C.
McPherson, W. B.

Assyrian Prose Composition: Professor HAUPT. W
4 p. m. (4).

Blake, F. R.
Foote, T. C.
Grimm, K. J.
McPhe

Assyrian Seminary: (*Nimrod Epic*): Professor HAUPT.
day, 2 p. m. (4).

Blake, F. R.
Foote, T. C.
Grimm, K. J.
McPhe

Comparative Semitic Syntax: Professor HAUPT. W
3 p. m. (6).

Blake, F. R.
Ember, A.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.
Wicker

Old Egyptian: (*Second Year*): Dr. JOHNSTON. Wedne
a. m. (5).

Blake, F. R.
Dennis, J. T.
Foote, T. C.
Grimm, K. J.
McPhe

Old Egyptian: (*Elementary*): Dr. JOHNSTON. Tuesday, 1

De Grange, M.

Coptic: Dr. JOHNSTON. Tuesday, 11 a. m., Thursday, 9 a. m

Blake, F. R.
De Grange, M.
Dennis, J. T.
Foote, T. C.
Grimm, K. J.
McPhe

English. (153 Students).

Classes meet in McCoy Hall.

English Seminary: *Epic poetry, especially Milton's Paradise*
Paradise Regained; and Beowulf: Professor BRIGHT. Tue
Thursday, 3–5 p. m., Room 4. (15).

Brown, G. D.
Crenshaw, J. B.
Eckenrode, H. J.
Embry, J.
Farr, J. M.
Fosnocht, E. B.
Griffith, G.
Hagen, S. N.
Heald, E. de F.
Huguenin, J.
Kennedy, J. B.
Miles, L. W.
Miller,
Schnei
West,

English Grammar: *Lectures on Anglo-Saxon Grammar:*
BRIGHT. Thursday, 12 m, Room 12. (8).

Brown, G. D.
Embry, J.
Farr, J. M.
Griffith, G.
Hagen, S. N.
Heald, E. de F.
Hugue
Miles,

Mediæval Literature: *Havelok the Dane:* Professor BRIG
day, 11 a. m., Room 4. (10).

Brown, G. D.
Embry, J.
Farr, J. M.
Griffith, G.
Hagen, S. N.
Heald, E. de F.
Huguenin, J.
Kennedy, J. B.
Miles,
Miller,

Journal Meeting: Professor BRIGHT. Alternate Fridays,
Room 4. (15).

Brown, G. D.
Crenshaw, J. B.
Eckenrode, H. J.
Embry, J.
Farr, J. M.
Fosnocht, E. B.
Griffith, G.
Hagen, S. N.
Heald, E. de F.
Huguenin, J.
Kennedy, J. B.
Miles, L. W.
Miller,
Schnei
West,

Anglo-Saxon: *Bright's Anglo-Saxon Reader:* (*Major Eng*
WEST. Tuesday, 11 a. m., Room 8, Thursday, 10 a. m., Roo

Eckenrode, H. J.
Ember, A.
Kennedy, J. B.
Lotspeich, C. M.
Miller, R. D.
Smull,

Advanced Old French Readings: Dr. BRUSH. Wednesday, 2–4 p. m., Room 7. (3).

Canter, H. V.
Critchlow, F. L.
Hicks, F. C.

Elementary Old French Readings: Dr. ARMSTRONG. Wednesday, 3 p. m., Room 2. (9).

Curdy, A. E.
Dawson, E. R.
Embry, J.
Fosnocht, E. B.
Harry, P. W.
Kurrelmeyer, H.
Lotspeich, C. M.
Morrison, A. J.
Teillard, X.

French Lyrics: Dr. OGDEN. Friday, 11 a. m., Room 2. (12).

Batchelder, J. D.
Critchlow, F. L.
Curdy, A. E.
Dawson, E. R.
Fosnocht, E. B.
Gould, W. E.
Harry, P. W.
Hicks, F. C.
Kurrelmeyer, H.
Lyon, C. E.
Morrison, A. J.
Stidman, A. G.

French Conversation: Mr. TEILLARD. Wednesday, 4 p. m., Room 2. (10).

Boyer, N.
Crenshaw, J. B.
Critchlow, F. L.
Curdy, A. E.
Harry, P. W.
Hicks, F. C.
Lotspeich, C. M.
Morrison, A. J.
Rehberger, G. E.
Struth, O. A.

Popular Latin: Professor ELLIOTT. Monday, 12 m., Room 2. (3).

Batchelder, J. D.
Gould, W. E.
Frost, F. L.

Old Provençal: Dr. ARMSTRONG. Thursday, 9 a. m., Room 2. (7).

Batchelder, J. D.
Critchlow, F. L.
Curdy, A. E.
Gould, W. E.
Morrison, A. J.
Mosemiller, C. A.
Shaw, J. E.

Spanish Seminary: Associate Professor MARDEN. Thursday, 11 a. m., Room 2. (3).

Batchelder, J. D.
Frost, F. L.
Gould, W. E.

Spanish Philology: Associate Professor MARDEN. Tuesday and Friday, 10 a. m., Room 2. (4).

Batchelder, J. D.
Canter, H. V.
Frost, F. L.
Gould, W. E.

Old Spanish Readings: Associate Professor MARDEN. Friday, 12 m. (5).

Canter, H. V.
Critchlow, F. L.
Curdy, A. E.
Harry, P. W.
Morrison, A. J.

Early Spanish Drama: Associate Professor MARDEN. Thursday, 12 m., Room 2. (8).

Batchelder, J. D.
Canter, H. V.
Critchlow, F. L.
Curdy, A. E.
Frost, F. L.
Gould, W. E.
Harry, P. W.
Morrison, A. J.

Methodology of the Romance Languages: Dr. KEIDEL. Monday, 9 a. m., Room 2. (5).

Critchlow, F. L.
Curdy, A. E.
Dawson, E. R.
Harry, P. W.
Morrison, A. J.

Romance Club: Professor ELLIOTT. Wednesday, 11 a. m., Room 2. (11).

Batchelder, J. D.
Critchlow, F. L.
Curdy, A. E.
Dawson, E. R.
Frost, F. L.
Harry, P. W.
Morrison, A. J.
Mosemiller, C. A.
Shaw, J. E.
Stidman, A. G.
Teillard, X.

Undergraduate Courses.

French: (*Major Course*): Dr. BRUSH. Monday, Wednesday, and Friday; Dr. OGDEN, Thursday, 10 a.m., Room 7. (7).

Crane, R. T.
Hill, J. P.
Lowndes, E.
Peters, J. G.
Sayler, J. A.
Swindell, W. B.
Tyler, J. E.

French: (*Minor Course, Class A*): Dr. ARMSTRONG. Daily, except Thursday, 12 m., Room 7. (20).

Anderson, R. B. T.
Cook, T. G.
Cronin, F. H.
Dapprich, F. R.
Duck, R. S.
Eager, J. H.
Griffin, J. W.
Griffith, W. A.
Hatch, E. C.
Hoffman, R. C.
Leopold, E. J.
Lisberger, S. J.
McAll, R. L.
Morse, R. B.
Purcell, T. N. D.
Raffel, H. B.
Rehberger, G. E.
Stein, J. S.
Struth, O. A.
Vogeler, C. A.

French: (*Minor Course, Class B*): Dr. OGDEN. Daily, except Thursday, 12 m., Room 6. (10).

Beck, G. C.
Bernheim, B. M.
Burrell, J. L. A.
Constantine, C. W.
Ewell, J. E.
Griffith, G.
Kennedy, J. B.
Liddell, D. M.
Mower, F. D.
Strouse, E.

French: (*Elementary Course*): Dr. BRUSH. Monday and Tuesday, 11 a. m., Room 7; Wednesday, 12 m., Room 8. (3).

Hattori, Y.
Hildt, J. C.
Lowndes, C. H. G.

French: (*Elective Course*): Dr. OGDEN. Thursday and Friday, 1 p. m., Room 11. (5).

Ember, A.
Foote, T. C.
Smith, W. L.
Warner, H. M.
Whitman, H. S.

Italian: (*Minor Course*): Dr. BRUSH. Monday, 9 a. m., Room 6; Tuesday, Thursday, and Friday, 9 a. m., Room 7. (3).

Greene, J. D.
Hullihen, W.
Taneyhill, G. L.

Italian: (*Elective Course*): Dr. OGDEN. Monday, 10 a. m., Thursday, 11 a. m. (4).

Ember, A.
Farr, J. M.
Hagen, S. N.
Huguenin, J.

Spanish: (*Minor Course*): Associate Professor MARDEN. Daily, except Monday, 9 a. m., Room 8. (8).

Bandel, J. M.
Bruce, E. S.
Ember, A.
Heyman, S.
Hill, W. B.
Kohn, W. I.
Norton, E. L.
Stephens, J. C.

Spanish: (*Elective Course*): Associate Professor MARDEN. Monday, 9 a. m., Friday, 1 p. m., Room 10. (5).

Farr, J. M.
Foster, F.
Huguenin, J.
Lowndes, E.
Weston, K. E.

Special Courses.

Spanish: (*Conversation Course*): Mr. GOULD. Monday and Tu
4 p. m., Room 8. (7).

Boyer, N.
Crenshaw, J. B.
De Grange, M.
Grasty, J. S.
Harry, P. W.
Norton, E. L.
Thomsen,

Spanish: (*Commercial Course*): Mr. GOULD. Thursday and F
4 p. m., Room 8. (5).

Bandel, J. M.
Crenshaw, J. B.
Harry, P. W.
Hollander, L. M.
Thomsen,

History, Politics, and Economics. (118 Studer

Classes meet in McCoy Hall.

Historical Seminary: Professor ADAMS. Alternate Fridays, 8
Room 25. (21).

Arnold, B. W.
Ayer, J. C.
Barnett, G. E.
Brander, W. W.
Cator, G.
Drewry, W. S.
Fisher, F. C.
Groome, P. L.
Hanna, H. S.
Harry, J. W.
Hattori, Y.
Johnson, E. C.
Kilby, B.
Martin, W. E.
Mulford, R. J.
Myers, W. S.
Radcliffe,
Smith, V.
Snavely, C.
Thorson, I.
Weaver, C.

Early History of Institutions: Professor ADAMS. Wedr
and Thursday, 11 a. m., Room 25. (20).

Arnold, B. W.
Ayer, J. C.
Barnett, G. E.
Cator, G.
Drewry, W. S.
Fisher, F. C.
Groome, P. L.
Hanna, H. S.
Harry, J. W.
Hattori, Y.
Johnson, E. C.
Kilby, B.
Martin, W. E.
Mulford, R. J.
Myers, W. S.
Peters, J.
Radcliffe,
Smith, V.
Thorson, I.
Weaver, C.

Educational Conference: Professor ADAMS. Friday, 11
Room 25. (18).

Arnold, B. W.
Ayer, J. C.
Barnett, G. E.
Brander, W. W.
Drewry, W. S.
Groome, P. L.
Hanna, H. S.
Harry, J. W.
Hattori, Y.
Johnson, E. C.
Kilby, B.
Martin, W. E.
Myers, W. S.
Radcliffe, G. L. P.
Smith, V.
Snavely, C.
Thorson, I.
Weaver, C.

History of Civilization: (*Major History*): Professor ADAMS.
day and Tuesday, 11 a. m., Room 24. (27).

Bandel, J. M.
Beeuwkes, H.
Bernheim, E. P.
Bird, A. R.
Boyer, N.
Bruton, A. W.
Bye, M.
Byrne, H. S.
Deen, E. W.
Duck, R. S.
Flinn, F. B.
Griffith, W. A.
Harris, W. H.
Hollander, L. M.
Johnson, E. C.
Kilby, B.
Kohn, W. I.
Morgan, S. C.
Peters, J. G.
Raffel, H. B.
Riggins, J. A.
Sayler, J.
Stein, J. S.
Swindell,
Tyler, J. E.
Weaver, C.
Whitman,

Historical Conference: Associate Professor VINCENT. F
10 a. m., Room 23. (8).

Brander, W. W.
Caldwell, W.
Drewry, W. S.
Groome, P. L.
Kilby, B.
Martin W. E.
Smith, V. E.
Thorson, I.

Reformation: Associate Professor VINCENT. Tuesday and T
day, 10 a. m., Room 23. (17).

Brander, W. W.
Caldwell, W.
Drewry, W. S.
Fisher, F. C.
Groome, P. L.
Hanna, H. S.
Harry, J. W.
Johnson, E. C.
Kilby, B.
Litsinger, W. H.
Martin, W. E.
Mulford, R. J.
Myers, W. S.
Radcliffe, G.
Smith, V. E.
Thorson, I.
Weaver, C. C

European History: (*Major History*): Associate Professor VINC
Thursday and Friday, 11 a. m., Room 23. (23).

Bandel, J. M.
Beeuwkes, H.
Bernheim, B. M.
Bird, A. R.
Boyer, N.
Bruton, A. W.
Bye, M.
Bryne, H. S.
Deen, E. W.
Duck, R. S.
Flinn, F. B.
Griffith, W. A.
Harris, W. H.
Kohn, W. I.
Morgan, S. C.
Raffel, H. B.
Riggins, J. A.
Sayler, J. A.
Stein, J. S.
Swindell, W.
Tyler, J. E.
Vogeler, C. A.
Whitman, H.

Historical Politics: (*History-Economics Course*): Associate Pro
sor VINCENT. Monday and Wednesday, 10 a. m., Room 23. (32

Abercrombie, R. T.
Anderson, R. B. T.
Baetjer, H.
Booker, J. M.
Breed, A. A.
Brooks, C. E.
Burrell, J. L. A.
Deen, E. W.
Eager, J. H.
Ewell, J. E.
Foster, F.
Grasty, J. S.
Greene, J. D.
Griffin, J. W.
Hyde, E. P.
James, W. McC.
Kerr, R. C.
Leopold, E. J.
McAll, R.
Mackall, L. L.
Manken, H.
Morgan, S. C.
Purcell, T. N. D.
Riggins, J. A.
Roulston, R.
Rous, F. B.
Routh, J. E.
Smith, W. L.
Spencer, E. M.
Stephens, J. C.
Turnbull, B.
West, A. P.

Diplomatic History of the Confederacy: Dr. CALLAHA
Monday and Wednesday, 10 a. m., Room 25. (8).

Drewry, W. S.
Harry, J. W.
Kilby, B.
Martin, W. E.
Radcliffe, G. L. P.
Snavely, C.
Thorson, I. A.
Weaver, C. C.

General History Examinations: Dr. BALLAGH. Tuesday,
a. m., Room 20. (7).

Brander, W. W.
Drewry, W. S.
Groome, P. L.
Myers, W. S.
Radcliffe, G. L. P.
Snavely, C.
Weaver, C. C.

Southern History: Dr. BALLAGH. Friday, 12 m., Room 20. (5

Drewry, W. S.
Groome, P. L.
Martin, W. E.
Peters, J. G.
Weaver, C. C.

Classical and Early European History: (*Minor History*
Dr. BALLAGH. Daily, except Tuesday, 10 a. m., Room 20. (20).

Bandel, B. B.
Bandel, J. M.
Barnett, E.
Cook, T. G.
Diggs, R. M.
Ford, C. E.
Griffith, W. A.
Guggenheimer, F. L.
Hatch, E. C.
Hill, E. C.
Hill, W. B.
Kirk, W.
Marbury, O.
Markell, C.
Pearre, A.
Ranft, C. F.
Schmeisser, W.
Sharretts, R. C.
Smith, S.
Strouse, E.

Conference in Parliamentary Law: Dr. Lee. Alternate Thursdays, 12 m., Room 24. (51).

Bandel, J. M.
Baldauf, L. K.
Bernheim, B. M.
Bird, A. R.
Booker, J. M.
Boyer, N.
Brady, J. H.
Briscoe, J. S.
Brown, E. B.
Bruton, A. W.
Byrne, H. S.
Constantine, C.W.
Cronin, F. H.
Dapprich, F. R.
Duck, R. S.
Ember, A.
Fishach, L. G.
Griffin, E. J.
Griffith, W. A.
Harris, W. H.
Hatch, E. C.
Hollander, L. M.
James, W. McC.
Kohn, W. I.
Leopold, E. J.
Lowndes, E.
Machen, J. G.
Manken, H.
Morse, R. B.
Mower, F. D.
Noble, E. R.
Norton, E. L.
Powers, H. W. S.
Raffel, H. B.
Rehberger, G. E.
Riggins, J. A.
Sayler, J. A.
Shippen, L. P.
Shreve, O. F.
Snavely, G. E.
Spencer, L. C.
Stein, J. S.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Tyler, J. E.
Vogeler, C. A.
Warner, H. M.
West, A. P.
Whitman, H. S.
Wolf, M. W.

Elements of Public Speaking: Dr. Lee. Assembly Room.

Wednesday, 1 p. m. (19).

Bandel, B. B.
Beasley, E. B.
Hildt, J. C.
Hoge, J. F. D.
Kenney, W. C.
Kirk, W.
Markell, C.
McGlone, B.
Murphy, L. C.
Pinkerton, T. C.
Putts, B. S.
Ranft, C. F.
Schmeisser, W. C.
Sharretts, R. C.
Sisco, G. E.
Slemons, J. A.
Smith, S.
Sneeringer, W. J.
Wroth, P.

Thursday, 1 p. m. (17).

Barnett, E.
Buttner, W. J.
Diggs, R. M.
England, J. T.
Golladay, R. E.
Guggenheimer, F. L.
Hand, J. P.
Hill, E. C.
Hill, H. D.
Hutzler, L. S.
Knapp, A. M.
Law, H. B.
Marbury, O.
Moore, R. E.
Pearre, A.
Reynolds, W. F.
White, L. J.

Friday, 1 p. m. (18).

Beeuwkes, H.
Bernheim, E. P.
Cameron, P. J. S.
Deen, E. W.
Dew, A. G.
Gillespie, H. C.
Heald, H. B.
Hildebrandt, L. F.
Koppelman, W. H.
Macht, D. I.
Mason, S. T.
Myers, C. A.
Ogle, M. B.
Pels, I. R.
Reider, C.
Stone, H. B.
Strouse, S.
Wolman, S.

Public Lecturing: (*For Graduate Students*): Dr. Lee. Thursday, 4 p. m., Donovan Room. (10).

STUDENTS IN THE JOHNS HOPKINS MEDICAL SCHOOL.

Candidates for the Degree of M. D. (209).

Fourth Year. (44).

Akerman, J.
Allen, H. W.
Austin, M. F.
Beale, A. E.
Bettmann, M.
Briggs, E.
Brown, L.
Brülle, H.
Burnam, C. F.
Chace, E. S.
Chittenden, A. S.
Christian, H. A.
Dancy, W. R.
Eggers, A. H.
Evans, H. C.
Fairbank, R.
Farrar, C. B.
Fisher, A. L.
Fisher, W. A.
Fletcher, H.
Flint, J. M.
Healy, W. P.
Hendrickson, W. F.
Hewlett, A. W.
Kellogg, W. C.
Kyes, P.
Lebus, L.
Lewis, W. H.
Little, H. W.
Lowell, E. L.
MacCallum, J. B.
Marvell, M. W.
Meltzer, C. R.
Mosher, C. D.
Myrick, H. G.
Rand, R. F.
Reed, D. M.
Rusk, G. Y.
Sabin, F. R.
Sowers, W. F. M.
Stone, E. A.
Warren, M.
West, J. M.
Woolley, P. G.

Third Year. (56).

Atherton, A. M.
Baetjer, F. H.
Baldwin, W. D.
Berry, J. M.
Blakeslee, W. H.
Bloombergh, H. D.
Boggs, T. R.
Bosley, J. R.
Bunting, C. H.
Butler, J. I.
Carey, H. W.
Chowning, W. M.
Comer, R. T.
Connor, G. L.
Connor, R.
Drake, G. S.
Dutcher, A.
Fowler, H. A.
Gay, F. P.
Graham, N. D.
Hall, G. W.
Hamman, L. V.
Hastreiter, R. F.
Hathaway, J. H.
Hitzrot, J. M.
Holden, G. R.
Hume, E. H.
Johnston, W. B.
Kauffman, B. B.
Kaufman, H. M.
Lamson, T.
Lewis, D. M.
Long, M.
Longcope, W. T.
Lyle, A. G.
Maddren, W. H.
Moore, E. S.
Parker, H. P.
Rubel, M. J.
Salter, J. C.
Simis, M. P.
Slemons, J. M.
Smith, H. M.
Spratt, C. N.
Stein, G.
Steinfeld, A. L.
Swett, C. M.
Ulrich, H. L.
Underhill, A. J.
Walker, M. B.
Warfield, L. M.
Warren, G. W.
Watts, S. H.
Wells, E. A.
Wells, M.
Winne, C. K.

Second Year. (59).

Auer, J.
Briggs, J. B.
Browne, B. B.
Bruns, R. M.
Bryan, W. M. C.
Bush, C.
Churchman, J. W.
Clarke, T. W.
Cook, H. W.
Coons, J. J.
Dohme, G. C.
Dolley, D. H.
Dudley, H.
Duffy, R.
Dunlop, J.
Eddy, D. L.
Erving, W. G.
Ferry, N. S.
Foster, N. B.
Francis, W. W.
Frankenthal, M. A.
Glenny, W. H.
Grant, J. F.
Hardy, C. F.
Haviland, M. L.
Haynes, M. S.
Hirshberg, L. K.
Horst, C. H.
Hyman, S.
Jelke, W. F.
Jones, T. M.
Karsted, A.
Kimball, A. H.
Lehr, L. C.
L'Engle, E. M.
Litchfield, G. V.
Lootz, E.
Ludlum, S. D.
MacGregor, G. M.
Marshall, S. A.
McFarland, J. S.
Meisenhelder, E. W.
Meisenhelder, J. E.
Ochsner, H. W.
Pelton, G. I.
Reede, E. H.
Riggins, E. N.
Rogers, C. P.
Scholl, G. B.
Silverberg, M.
Simpson, J. N.
Steele, H. M.
Tallant, A. W.
VanArsdall, C. B.
VanDenburg, J.
Wight, O. B.
Williams, C. L.
Williams, D.
Wright, C. B.

First Year. (50).

Barker, M. L.
Bassett, V. H.
Bennett, R.
Bixler, L. C.
Blauvelt, E. H.
Brush, C. E.
Chatard, J. A.
Chinn, G. E.
Clark, A. H.
Cornell, W. B.
Dewey, E. G.
Edwards, R. T.
Fayerweather, R.
Fischer, J. S.
Gaenslen, F. J.
Gaines, L. M.
Geraghty, J. T.
Goldsborough, F.C.
Haskell, L. W.
Hirschfelder, A.D.
Hopkins, R.
Hunter, P. S.
Hutchins, H. T.
Jones, C. L.
Keidel, A.
Kingsbury, H. P. D.
Lazenby, M.
Loevenhart, A. S.
Long H. D.
Lupton, E. J. S.
Lynch, L. A.
Manning, W. S.
Marshall, W.
McClintock, R. W.
Miller, R. T.
Morse, M. E.
Moulton, W. B.
Neagle, H. B.
Rainforth, S. I.
Riley, B. F.
Robinson, G. C.
Schmitter, F.
Schultz, O. T.
Smith, W. H.
Stevens, A. R.
Tayler, L.
Thompson, W. L.
Travis, C. H.
Watson, F. H.
Young, C. W.

Physicians Attending Special Courses. (14).

Curtiss, R. M.
Fearn, T.
Garner, M. E.
Kerr, A. T.
Kibbe, M. E.
Latimer, C. W.
Middleton, J. I.
Miller, W. McN.
Newton, D. H.
Otis, F. J.
Potter, C. H.
Somers, G. B.
Thompson, W
Wilson, G.

HOPKINS SCHOLARSHIPS.

Hopkins Scholarships for the current academic year have recently awarded as follows :—

To Graduate Students:

Honorary.

J. R. C. Brown, of Virginia.

Ordinary.

H. A. Converse, of Virginia.
J. M. Love, of Virginia.
C. D. Harris, of North Carolina.
R. H. Watkins, of North Caro

To Undergraduates from Maryland:

Ordinary.

S. Wolman,
I. R. Pels,
D. I. Macht,
S. Strouse,
C. Markell, Jr.

The Johns Hopkins Press has just issued a volume on Cuba and In NATIONAL RELATIONS, by James M. Callahan, Lecturer in Diplo History, Johns Hopkins University. The volume contains 503 p octavo, and is sold at the price of three dollars.

This is probably the first book treating Cuba entirely from the st point of its position and influence in American history and internati relations.

The political conditions in Spain, as well as those in Cuba and Ame are presented so far as they have any bearing upon the subject.

The author has made a careful examination of original sources. materials of his work are drawn from a study of several years among archives at Washington.

In the Critical Edition of the Hebrew Text of the Polychrome Bi directed by Professor Haupt, the following parts have just appeared:

The Book of Ezekiel, edited by Professor C. H. Toy, LL. D., of Harv University.

The Book of Isaiah, edited by Professor T. K. Cheyne, M. A., D. D., the University of Oxford.

The journal "Terrestrial Magnetism and Atmospheric Electr city," edited by L. A. Bauer, Ph. D., Lecturer on Terrestrial Magnetis will be hereafter published by The Johns Hopkins Press. The journal now in its fourth volume. It appears quarterly.

The volume of Studies in State Taxation, with Particular Re erence to the Southern States, edited by Dr. J. H. Hollander, is no in press and will appear early in January.

The pupils of Professor William H. Welch have decided to give e pression to their regard for him by the publication of a volume to ma his twenty-fifth year as a teacher and investigator.

During the past twenty-five years some seventy-five persons have unde taken investigation under Dr. Welch's leadership and nearly half of the will contribute to the volume mentioned.

The volume will be royal octavo in size and will contain at least fi hundred pages of printed matter. It will, in addition, be illustrated wi many lithographic plates and text figures. It will contain contributio to pathology and to correlated sciences agreeing in scope with that of t leading scientific medical journals. Special announcements will be sent application to Professor Mall, Johns Hopkins Medical School.

W. E. Henderson (Fellow, 1895-96, Ph. D., 1896)—Assistant Professor of Analytical Chemistry, Ohio State University.

Nicholas Knight (Fellow by Courtesy, 1894-95, 1898-99)—Professor of Chemistry, Cornell College, Iowa.

S. R. McKee (Ph. D., 1895)—Professor of Chemistry, Southwestern Presbyterian University, Tenn.

R. Harry Thomas (A. B., 1899)—Instructor in Chemistry, Williamson School, Philadelphia.

C. E. Waters (A. B., 1895, Ph. D., 1899)—Instructor in Chemistry, etc., Centenary Collegiate Institute, Hackettstown, N. J.

F. D. Wilson (Ph. D., 1899)—Assistant in Chemistry, Tufts College.

J. H. C. Winston (Ph. D., 1899)—Adjunct Professor of Physical Science, Hampden-Sidney College.

Natural Sciences.

Cleveland Abbe, Jr. (Fellow, 1897-98, Ph. D., 1898)—Professor of Natural Sciences, Winthrop Normal and Industrial College, S. C.

R. M. Bagg (Ph. D., 1895, Assistant, 1895-97)—Instructor in Natural Science, Public Schools, Colorado Springs, Colo.

E. W. Berger (Ph. D., 1899)—Professor of Biology, Baldwin University, Ohio.

H. L. Clark (Fellow, 1896-97, Ph. D., 1897)—Professor of Biology, Olivet College.

F. W. Cragin (Ph. D., 1899)—Professor of Geology, Colorado College. [*Resumption of former position.*]

L. C. Glenn (Fellow, 1898-99, Ph. D., 1899)—Associate Professor of Biology and Geology, South Carolina College.

U. S. Grant (Fellow, 1891-92, Ph. D., 1893)—Professor of Geology, Northwestern University.

Caswell Grave (Fellow, 1898-99, Ph. D., 1899)—Adam T. Bruce Fellow; scientific investigator for the U. S. Fish Commission, 1899.

D. S. Johnson (Fellow, 1896-97, Ph. D., 1897, Bruce Fellow, 1897-98, Assistant, 1898-99)—Associate in Botany. [*Promotion.*]

J. L. Kellogg (Fellow, 1891-92, Ph. D., 1892)—Assistant Professor of Biology, Williams College.

A. L. Lamb (A. B., 1888)—Science Master, Country School for Boys, Baltimore.

George Lefevre (A. B, 1891, Ph. D., 1896, Fellow, 1894-95, Bruce Fellow, 1895-97, Assistant, 1897-98)—Professor of Zoology, University of Missouri.

A. G. Leonard (Ph. D., 1898)—Acting Professor of Geology, University of Missouri.

E. B. Mathews (Fellow, 1893-94, Ph. D., 1894, Instructor and Associate, 1894-99)—Associate Professor of Mineralogy. [*Promotion.*]

G. B. Shattuck (Fellow, 1896-97, Ph. D., 1897, Instructor, 1897-99)—Associate in Physiographic Geology. [*Promotion.*]

S. Watase (Bruce Fellow, 1889-90, Ph. D., 1890)—Professor of Cellular Biology, University of Tokyo.

Medicine.

C. R. Bardeen (M. D., 1897, Assistant, 1897-99)—Associate in Anatomy. [*Promotion.*]

J. G. Clark (Associate, 1898-99)—Professor of Gynecology, University of Pennsylvania.

P. M. Dawson (A. B., 1894, M. D., 1898, Fellow, 1898-99)—Assistant in Physiology.

G. W. Dobbin (A. B., 1891, Assistant, 1895-99)—Associate in Obstetrics. [*Promotion.*]

Simon Flexner (Fellow, Associate, Associate Professor, and Professor of Pathological Anatomy, 1891-99)—Professor of Pathology, University of Pennsylvania.

W. W. Ford (M. D., 1898)—Fellow in Pathology, McGill University.

F. T. Fulton (A. B., 1895, M. D., 1899)—Pathological Interne, City Hospital, Boston, Mass.

L. P. Hamburger (A. B., 1893, M. D., 1897)—Assistant in Medicine.

R. G. Harrison (A. B., 1889, Fellow, 1893-94, Ph. D., 1894, Bruce Fellow, 1894, Instructor and Associate, 1896-99)—Associate Professor of Anatomy. [*Promotion.*]

H. McE. Knower (A. B., 1890, Fellow, 1894-95, Bruce Fellow, 1895-96, Ph. D., 1896)—Instructor in Anatomy.

H. T. Marshall (A. B., 1894, M. D., 1898)—Fellow in Pathology.

E. L. Opie (A. B., 1893, M. D., 1897, Fellow, 1898-99)—Second Assistant in Pathology.

R. G. Perkins (M. D., 1898)—Demonstrator of Pathology, Western Reserve University.

M. T. Sudler (Ph. D., 1899)—Assistant in Anatomy.

J. W. Williams (A. B., 1886, Associate and Associate Professor, 1893-99)—Professor of Obstetrics. [*Promotion.*]

OBITUARY.

GEORGE ALLISON HENCH (Ph. D., 1889).

[Reprinted from *Modern Language Notes, Baltimore, November*, 1899.]

On a tour in the White Mountains, last summer, Professor Hench, of the University of Michigan, was thrown from his bicycle and received injuries which resulted in his death four days later, on the sixteenth of August.

He was born at Centre, Pennsylvania, on the fourth of October, 1866, and received his collegiate education at Dickinson College, entering the Freshman class in 1881, and at Lafayette College, where he spent the last three years of his course, and was graduated with the degree of Bachelor of Arts in 1885. He then took up the study of Germanic Philology at the Johns Hopkins University, and remained matriculated there for four years; during the summer semester of 1887, however, he attended courses at the University of Berlin. The excellence of his work at Johns Hopkins won for him, in June of the following year, the Fellowship in German; the remainder of the summer he spent at Vienna, collecting, in the Imperial Library, the material for his dissertation. In June 1889 he received the degree of Doctor of Philosophy. After another year of study in the universities of Heidelberg and Berlin he was appointed instructor in German in the University of Michigan, where he met with rapid promotion. Within a twelve-month he was made Assistant Professor of Germanic Philology, and in 1896, though then barely thirty years old, he succeeded Professor Thomas as Professor of Germanic Languages and Literature, and head of the German Department; which position he continued to hold until his untimely death.

As a scholar, Professor Hench won an enviable reputation at the very outset of his career, by his dissertation on the *Monsee Fragments*, 1890, a "diplomatic-critical" edition of the Vienna and Hanover manuscripts of these Old-High-German texts, with their Latin originals, notes on variant readings, etc., and a grammatical treatise; to which were added, later in the same year, an introduction, an exhaustive glossary, and a photo-lithographic facsimile. It was an excellent piece of work, distinguished by extraordinary discernment of minute paleographic details, by acumen and independence of judgment in the discussion of the origin and the history of the manuscripts, and by accurate scholarship and painstaking thoroughness throughout; qualities which marked the author at once as a man of unusual promise. They were alike characteristics of his second work, an edition of one of the most important Old-High-German translations from the Latin, that of the tractate of Isidorus *De Fide Catholica contra Judaeos.* It was published in 1893 as volume lxxii of the *Quellen und Forschungen*, under the title *Der Althochdeutsche Isidor, Facsimile-Ausgabe des Pariser Codex nebst critischem Texte der Pariser und Monseer Bruchstücke*, and was provided, like the author's first publication, with an introduction, a grammatical treatise, and a complete vocabulary. It is now the standard edition of that text, and needs only to be reprinted in a less expensive form, without the facsimiles, in order to be in the hands of every student of Old-High-German. Outside of these larger works, Professor Hench has published but little: reviews of Kuno Fischer's *Goethes Tasso* and Zangemeister und Braune's *Bruchstücke der altsächsischen Bibeldichtung aus der Bibliotheca Palatina*, in the *Mod. Lang. Notes*, Vols. vi and ix; an article on the Gothic *guþ* in Paul und Braune's *Beiträge*, Vol. xxi; and an article on *The Voiced Spirants in Gothic*, in the *Journal of Germanic Philology*, Vol. i. * * * * * * * It was upon his motion that the Modern Language Association, in 1896, appointed the Committee of Twelve on secondary instruction in the Modern Languages, whose admirable report has just appeared; he was a member of the sub-committee on methods, and at the general meeting of the committee a year ago, he strenuously exerted his influence in favor of high ideals and rigid standards in secondary education.

Taken for all in all, he was, in his devotion to scholarly ideals amid the deadening routine of administrative work, in his thoroughness as a teacher, and in the breadth of his sympathies as an educator, a rare embodiment of all that is best in the American type of a university man.

H. K. Schilling.

A memorial of Professor Hench by his friend and former associate at Ann Arbor, Professor Calvin Thomas, appears in the *Journal of Germanic Philology*, Vol. II (1899), No. 4, pp. 550-554. A portrait of Professor Hench is also given in that number of the *Journal.*

PUBLIC EDUCATIONAL COURSES, 1899–1900.

During the current academic year the scope of the winter courses of public instruction will be somewhat widened. Last season a single course of twenty lectures was given in the representative science of Physical Geography. This year there will be an advanced course in this subject, including Meteorology, and also a course of twenty lectures in Physics, including laboratory exercises.

The lectures in physical géography are given under the auspices of the Geological Department. Dr. Shattuck, who opens the course, is, in addition to being one of the associates in Geology, Chief of the Coastal Plain Division of the Maryland Geological Survey and has made a special study of physiographic processes.

Dr. Fassig, in addition to being an instructor in meteorology at the University, is also a Section Director of the U. S. Weather Bureau, assigned to work in connection with the Maryland State Weather Service, and has a very intimate knowledge of the meteorology of Maryland.

The course in Physics will be under the direction of Professor Ames and will be given in the Physical Laboratory.

The courses are designed to offer instruction in various branches of Physics, making a fairly systematic course. The lectures will be illustrated by experiments and by lantern démonstrations, and will be suited for a public audience as well as for those who are teachers or students.

The laboratory exercises will be offered exclusively to teachers of Physics, and an attempt will be made to offer suitable instruction in the preparation of lectures and in the direction of laboratory work.

Last season a course of twenty lectures was given upon historical and educational subjects.

This year three short courses of lectures in English Literature, by Professor Albert H. Smyth, of Philadelphia, have been promised and will be illustrated by lantern views.

It will not be possible for any one to attend all of these classes. Some will be held on Friday evenings and Saturday mornings, at times the most convenient for public school teachers. Other courses will be given in the afternoon, during the week, on days to be announced later; but all of the following will be public educational courses and open to applicants at a moderate charge.

Citizens of Baltimore and Maryland, whether engaged in teaching or not, will enjoy in the winter season the privileges which in some academic communities are offered in summer sessions.

The attention of clergymen, charity organization workers, and the friends of municipal improvement is especially called to the two courses of Dr. Jeffrey R. Brackett and Dr. J. H. Hollander (author of "The Financial History of Baltimore"), devoted to "Studies of the Modern City."

Subjects, hours, and fees for all these courses are given in a special circular.

I. Advanced Physical Geography.

(1) **GEOLOGY.** Five class lectures by Dr. GEORGE B. SHATTUCK, Saturday mornings, at 10.30, and continuing weekly at this hour in the same place.

(2) **METEOROLOGY.** Fifteen class lectures by Dr. OLIVER L. FASSIG, will be given on Saturday mornings after the close of Dr. Shattuck's course.

Friday afternoon informal conferences on the practical bearings of meteorology and on the work of meteorological bureaus will be arranged for those taking the course in Physical Geography.

II. Physics.

There will be two courses in Physics, as follows:

First, a Series of Twenty Lectures on Special Topics by Professor AMES. This course will be given on Saturdays, at 9 a. m., in the Physical Laboratory. The lectures will be illustrated by experiments and demonstrations.

Second, a Laboratory Course designed for Teachers of Physics. This will consist of work in the Physical Laboratory on Saturday mornings, at 10 o'clock; and opportunities will be given the members of the class to set up apparatus for lecture purposes and to perform suitable experiments.

III. Studies of the Modern City.

Part 1. **PUBLIC AID, CHARITY, AND CORRECTION.** A course of ten lectures is offered by Dr. JEFFREY R. BRACKETT upon problems of Public Aid, Charity, and Correction, with particular reference to social conditions in the large cities of the United States. Beginning with the growing opportunities and the need of education for social service, the lectures will treat the general tendencies towards the restoration of dependents and the prevention of dependence. Illustrations will be given from conditions in Baltimore, and the course is aimed to be of especial use to clergymen and to students who plan to take up practical social work.

The topics will be as follows:

1. Study of Philanthropy; 2. Causes of Poverty, Pauperism and Crime; 3. The Aim of Philanthropy; 4. Treatment of the Homeless; 5. Treatment of the Resident Needy; 6. Public Aid or Charitable Aid; 7. Reformation; 8. Child-saving; 9. Neighborhood Improvement and Personal Contact; 10. The Church as a Factor in Social Progress.

Part 2. **CITY GOVERNMENT AND CITY IMPROVEMENT.** A course of ten lectures, following Dr. Brackett's, is offered by Associate Professor J. H. Hollander upon the principles and practice of Municipal Government, with particular reference to current municipal problems in the United States. The method of treatment will be descriptive, critical and comparative. Beginning with a discussion of the growth and significance of the modern industrial city, attention will be paid to the characteristic features of municipal organization in Great Britain, France and Germany. The evolution of the American city will then be traced, and detailed study made of municipal administration, finances and functions in the United States. In conclusion, the future and the possibilities of the American city will be discussed.

The topics will be as follows:

1. The Problems of Municipal Government; 2. The Growth of Cities; 3. Municipal Government in Great Britain; 4. Municipal Government in France; 5. Municipal Government in Germany; 6. The Evolution of the American City; 7. Municipal Administration in the United States; 8. Municipal Finances in the United States; 9. Municipal Functions in the United States; 10. The Possibilities of the American City.

IV. Modern English Literature.

(1) **LIVING WRITERS OF ENGLAND.** Six class lectures by Professor ALBERT H. SMYTH, of Philadelphia, in McCoy Hall.

(2) **THE LAKE COUNTRY—PAST AND PRESENT.** These lectures, also by Professor Smyth, are illustrated with entirely new lantern views. The photographs of Cumberland scenery and of Westmoreland places and people were taken under Professor Smyth's direction.

(3) **BURNS AND SCOTT.**

A series of lectures on special educational topics will also be given.

Special circulars as to the above courses will be issued from time to time and may be had at the Office of the Registrar of the University.

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HOURS FOR LECTURES AND RECITATIONS, FIRST HALF-YEAR, 1899-1900.

HOURS.	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
A. M. 9	Riemann's Surfaces. (Craig.) (8 a. m.) Automorphic Functions. (Craig.) Chem.: Journal Meeting. (Remsen.) English Literature. (Greene.) Italian: Minor. (Brush.) Analytic Geom: Minor. (Hulburt.) Geological Physics. (Reid.) Solid Geometry: Elem. (Cohen.) German Readings. (Baker.) Middle High German. (Vos.) Spanish: Elective. (Marden.) Romance Methodology. (Keidel.) Economics. (Sherwood.)	Riemann's Surfaces. (Craig.) (8 a. m.) Automorphic Functions. (Craig.) Organic Chemistry. (Remsen.) Chem.: Minor. (Renouf and Gilpin.) Chemistry: Major. (Morse.) Latin Composition. (Sutphen.) Italian: Minor. (Brush.) Determinants and Calculus. (Hulburt.) Historical Geology. (Clark.) Zoology: Major. (Brooks & Johnson.) Differential Equa. (Cohen.) (8 a. m.) German Oral Exercises. (Hofmann.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Arabic: Elem. (Johnston.) Physiology. (Dreyer.) Economic Thought. (Hollander.) Roman Literature. (Smith.) Thukydides. (Miller.)	Theory of Surfaces. (Craig.) Organic Chemistry. (Remsen.) Chem.: Minor. (Renouf and Gilpin.) Chemistry: Major. (Morse.) Livy. (Sutphen.) Determinants and Calculus. (Hulburt.) Historical Geology. (Clark.) Zoology: Major. (Brooks & Johnson.) German Oral Exercises. (Hofmann.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Physiology. (Howell.) Economic Thought. (Hollander.) Physics: Adv. (Dorsey.)	Differential Equa. (Craig.) (8 a. m.) Theory of Surfaces. (Craig.) Organic Chemistry. (Remsen.) Chem.: Minor. (Renouf and Gilpin.) Chemistry: Major. (Morse.) Livy. (Sutphen.) Italian: Minor. (Brush.) Determinants and Calculus. (Hulburt.) Geological Physics. (Reid.) Zoology: Major. (Brooks & Johnson.) Middle High German. (Vos.). Spanish: Minor. (Marden.) Coptic. (Johnston.) Physiology. (Howell.) Old Provençal. (Armstrong.) Commerce. (Sherwood.) Dio Chrysostom. (Spieker.) Thukydides. (Miller.)	Differential Equa. (Craig.) (8 a. m.) Organic Chemistry. (Remsen.) Chem.: Minor. (Renouf and Gilpin.) Chemistry: Major. (Morse.) Livy. (Sutphen.) Italian: Minor. (Brush.) Determinants and Calculus. (Hulburt.) Zoology: Major. (Brooks & Johnson.) Differential Equa. (Cohen.) (8 a. m.) Transformation Groups. (Cohen.) German: Elem. (Vos.) Spanish: Minor. (Marden.) Physiology. (Dreyer.) French Grammar. (Armstrong.) Commerce. (Sherwood.)	Experimental Physics. (Huff.) (9-12.)
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3	Hebrew: Elem. (Haupt.)	Old Testament Seminary. (Haupt.) English Seminary. (Bright.) Drawing. (Whiteman.)	Compar. Semitic Syntax. (Haupt.) Old French Readings. (Brush.) Old French Read.: Elem. (Armstrong.)	English Seminary. (Bright.) Drawing. (Whiteman.)	Post-Biblical Hebrew. (Rosenau.) History of Philosophy. (Griffin.)	
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THE PUBLIC ... ASTOR, LENOX AND TILDEN FOUNDATIONS

REPORT OF A SPECIAL COMMISSION SENT TO THE PHILIPPINES BY THE JOHNS HOPKINS UNIVERSITY TO INVESTIGATE THE PREVALENT DISEASES OF THE ISLANDS.

By Professor S. FLEXNER, M. D., and Professor L. F. BARKER, M. D.

ORT UPON AN EXPEDITION SENT BY THE JOHNS HOPKINS UNIVERSITY TO INVESTIGATE THE PREVALENT DISEASES IN THE PHILIPPINES.

RESIDENT GILMAN, DOCTORS WELCH AND OSLER,
Philippine Committee of the Johns Hopkins University Medical School.

tlemen:—We have the honor to submit to you a brief account of our
and movements in carrying out your commission to study the preva-
iseases in the Philippine Archipelago. Your commissioners, consist-
Dr. Simon Flexner and Dr. L. F. Barker, to whom were voluntarily
ed Messrs. J. M. Flint and F. P. Gay, of the Medical School, the
having given their time and paid all their own expenses, sailed from
ouver on March 29th, 1899, and arrived in Manila May 4th, where
mmediately established themselves for the purpose of the work men-
. Owing to the military situation it was found impracticable to visit
ports in the Archipelago or to penetrate into the interior of the
of Luzon. The entire time, therefore, of the commission was spent
study of disease existing among the natives and American troops in
a and at Cavite.

WORK IN JAPAN AND HONG-KONG.

transport sailings were uncertain and the passage out by them slow,
decided to save time and go by fast steamer, the Canadian Pacific
ay giving especial rates to the commission on tickets around the
.

original plan of your commissioners was to proceed directly to Manila
y of Hong-Kong, at which latter port it was intended to stop only
nough to outfit for the tropics and to catch the earliest steamer sail-
r Manila. After consideration of the probability that certain new
or phases of disease, not occurring in temperate regions, might be
ntered in the Archipelago, and of the fact that the diseases of the
ppines would probably have much in common with those of Japan, it
ecided to spend one week in Japan, where modern hospitals could be
l and advantage taken of the results of the study of tropical disease
ghly trained and eminent Japanese physicians. The decision proved
valuable in many ways; and we especially desire to express our obli-
s to Professors Aoyama, Mitsukuri, Miura and Kitasato, who showed
ny courtesies. The opportunity to see in the Japanese hospitals pure and mixed examples of beri-beri assisted us greatly in our subsequent studies, as did also the observations on dysentery made in the Institute for Infectious Diseases at Tokio.

While outfitting at Hong-Kong we improved the opportunity to study the bubonic plague, which was still prevailing at that port. This study was made easy by the generosity and courtesy of the English Civil Physician, Dr. James Lowson, in charge of the Plague Hospital and Mortuary. The study begun in this way was extended when two months later we returned to Hong-Kong, en route to America. At this time a considerable exacerbation of the disease had taken place, and within a week or ten days we saw several scores of cases and performed many autopsies. The several forms of infection: inguinal; axillary; tonsillar and cervical and pulmonary, were thus encountered. Bacteriologial examinations were made and tissues collected for future study. Two of the party (Dr. Barker and Mr. Flint) spent on the return journey three weeks (at their own expense) in India, where the great epidemics of plague there raging were observed.

ARRIVAL IN MANILA.

Immediately upon our arrival in Manila quarters were sought at the "Hotel de Oriente." Very insufficient accommodations were secured for a limited time, as the sudden accession of families of Army and Naval officers had strained the hotel to its fullest capacity. Having been forewarned of the conditions of living in Manila, we took the precaution to bring with us from Hong-Kong a group of Chinese servants, intending to set up housekeeping if practicable. After much difficulty a small house was secured in San Miguel, where, by hiring parts of the furnishings and buying what could not be rented, a temporary establishment was secured.

Within a few hours after our arrival the credentials and private letters brought were presented to Colonel Woodhull, Surgeon-in-Chief to the 8th Army Corps and to General Otis. Colonel Woodhull afforded us every opportunity to prosecute our work in the military hospitals. Although no special introduction was in our possession, we quickly met Dr. Bournes, chief health officer of Manila, who opened to us the hospitals under his charge. Somewhat later we met Dr. Pearson, Chief Naval Surgeon, who opened the Naval Hospital at Cavite to us.

HOSPITALS IN MANILA.

Civil Hospitals. These consist of a large hospital within the walled city, *San Juan de Dios.* It has a capacity of from 250 to 300 beds and accommodated during our stay both natives and Europeans. The number of European patients was small. When the military hospitals were much crowded a certain number of wounded prisoners of war were accommodated. The hospital contained chiefly native medical cases of both sexes. The *San Lazaro* or leper hospital, in the outskirts of Manila, contained from 80 to 100 lepers during our stay. These had come from Luzon, almost exclusively from Manila and its immediate surroundings. The two sexes are provided or in separate, large and airy wards. One wing of the building, having a private entrance, is devoted to native prostitutes who apply regularly for examination and are incarcerated here and treated medically when found to be suffering from venereal disease.

Military Hospitals. These consisted, beside the regimental hospitals which were virtually detention camps, of three Reserve Hospitals—the 1st, 2nd and 3rd Reserve Hospitals; a convalescent hospital on Corregidor Island and the Hospital Ship *Relief*, which was anchored in the bay. The First Reserve Hospital, under the control of Major Crosby, had been originally the Spanish military hospital. It had been from time to time, by the erection of tents over platforms raised a foot or two from the ground, increased in capacity until in July it contained 1200 or more beds. The Second Reserve Hospital, under the control of Major Keefer, was a transformed modern school building and because of its limited capacity (250 beds), high ceilings and wide corridors it made a model hospital. The Third Reserve Hospital had just been established towards the end of our visit and was smaller than the others and intended as a convalescent hospital. The hospital at Corregidor is a temporary structure and intended for convalescents. It is especially well adapted for its purpose because of the high and hilly character of the island and its complete investment by the sea. The *Relief* was used as a hospital for acute cases; but some time before we left the acute cases were transferred to the Reserve Hospitals and the *Relief* sailed for San Francisco with invalided men.

The Reserve Hospitals accommodated especially American sick and wounded; but a ward in the First Reserve Hospital was set aside for the Filipino wounded.

After the outbreak of beri-beri at Cavite a hospital under military control was established at San Roque in the remains of the Spanish Marine Hospital which had been wrecked by the insurgents.

Naval Hospital. A small hospital for sick seamen and marines was established at Cavite. Through the courtesy of Dr. Pearson this was open to us for clinical studies.

Clinical, Pathological and Bacteriological Laboratory. Through the kindness of Colonel Woodhull and Major Crosby, the officer-in-chief of the First Reserve Hospital, a small Filipino house, situated on the banks of the Pasig, was given us in which to establish a laboratory. This was done on the second floor of the house. The expense of putting up working-tables was kindly borne by the Medical Corps of the Army. The laboratory equipment was set up in this building and within a very few days after our arrival work was begun. We desire to speak of the co-operation of the Medical Staff of the hospital who afforded us every opportunity to visit the wards and many of whom joined or assisted us in clinical and pathological work. We wish especially to acknowledge the co-operation and assistance of Lieut. Richard P. Strong, a graduate of the J. H. U. Medical School, who had on our arrival already begun to do laboratory work and who gave up much of his valuable time in furthering our interests. It was found unnecessary to establish laboratories in the other hospitals, in the first place because all were connected with the First Reserve by the Signal Service telegraphic system of which we had free use; and next because all the dead were carried to the morgue in conjunction with the First Reserve Hospital. We went or were frequently called to the other hospitals to make clinical and bacteriological examinations.

With few exceptions, all the dead were subject to autopsy. Postmortem examinations were made at the Civil Hospitals upon natives and at the Military Hospital upon all that died. Exceptions were made only in the cases of those dead from gunshot wounds, when, if pressed for time, necropsies were sometimes omitted.

Prevailing Diseases.

The subject of the prevalent diseases may be considered as they affect (1) the natives, and (2) Europeans and Americans, especially the American garrison.

Diseases affecting Natives. (a) *Skin Diseases.* Of the skin diseases prevailing among the natives, aside from small-pox and other specific exanthemata, may be mentioned (1) diseases of the scalp, which are very frequent (2) dhobie itch; and (3) an affection which resembles closely and which is probably identical with Aleppo boil (Delhi boil, Biskra button, *epidemische Beulenkrankheit*). (b) *Small-Pox.* This disease has been so generally prevalent in Luzon that the natives have to a large extent lost fear of it. All evidence points to the greatest carelessness in preventing its spread during Spanish times. Isolation of the sick and disinfection of the habitations seem not to have been attempted, and vaccination, even among the Spanish garrison, had not been carried out. Under these circumstances it could be no surprise that after the American occupation the disease should appear and even become epidemic. The epidemic which appeared early last year was promptly met by Dr. Bournes, who caused the Spanish garrison still in Manila and the natives and Chinese within the city to be vaccinated. In order to insure satisfactory results he found it necessary to establish a vaccine farm in which young *carabao* were used for the preparation of the virus. Under the influence of this measure and by the aid of isolation of the sick the disease had in May practically disappeared within the military lines about Manila. (c) *Leprosy.* A definite focus of this disease exists in Luzon. The cases, in the neighborhood of 100, which were confined in the San Lazaro Hospital came from Manila and the country immediately surrounding that city. The disease affected both sexes, being more frequent in adults, although also present in half-grown boys and girls. The commonest forms were the tubercular and mutilating. Autopsies were performed upon several cases that had died during our stay. (d) *Tuberculosis.* Accurate statistics of the extent of the prevalence of this disease are difficult if not impossible to obtain. That the disease is a common one is indicated by several facts. It is frequently met with in the native hospitals, where it may have been recognized during life or is disclosed at autopsy. Many cases of supposed beri-beri which we autopsied at San Juan de Dios proved to be tuberculosis. It is possible that the two diseases had co-existed, for we found such combinations freely recognized by Japanese physicians in the hospitals in Japan. Tuberculosis of the lungs was also found as a common complication in leprous individuals that came to autopsy. A not very infrequent spectacle met with on the streets are much emaciated and weak natives, affected with suggestive coughs and free expectoration. While it is not certain that these individuals were examples of tuberculosis, there is strong probability that this explanation of their condition is the correct one. (e) *Venereal Disease.* Syphilis, by general agreement (statistics not available), does not prevail unduly. Chancroids and gonorrhœa are, on the other hand, very common. The majority of the prostitutes confined in the San Lazaro were victims of these two diseases. A very common complication of the soft sore, owing to lack of cleanliness, is swelling and suppuration of the inguinal glands. (f) *Beri-Beri.* This disease is well known among the natives. It would appear to be epidemic and endemic in Luzon. It is, judging from cases met with in San Juan de Dios Hospital and the statements of native physicians, constantly appearing in a sporadic form. During our stay an epidemic appeared among the Filipino prisoners confined at Cavite. Some 200 cases developed in a few weeks; the mortality ranged from 20 to 30 per cent. The several recognized forms of the disease—œdematous, paralytic, and mixed—were encountered. Clinical and bacteriologial studies were made upon the living, and the dead were subjected to autopsy and bacteriological examination. The difficulty of getting to and fro between Manila and Cavite on account of the impossibility of land communication, made this part of our work difficult and time-consuming. A considerable collection of pathological material and other data has been made. This material is now in process of study and arrangement.

Diseases affecting Americans. The chief causes of disability among the American land forces are the enteric diseases. These are diarrhœa, dysentery, typhoid fever, and gastro-intestinal catarrhs. Many of the diarrhœas are merely preliminary to the symptoms of dysentery. Other infectious fevers are relatively infrequent. A small number of cases of scarlet fever and diphtheria only were encountered. The malarial fevers prevailed but not seriously during the months of May, June, and July. (a) *Dysentery.* This disease is responsible for the greatest amount of invalidation and the highest mortality. It appears in acute, sub-acute, and chronic forms. The chronic form is sometimes attended by secondary abscess of the liver. The acute form may end in 24, 48, or 72 hours. In it the whole of the large intestine and usually the lower portion of the ileum is involved. The

us membrane of the gut is swollen, congested and oedematous, in
haemorrhages have taken place into the mucous membrane and the
ucosa is swollen and its blood-vessels greatly dilated. No ulcers
d in such cases. Amoebae were absent or very difficult to find in the
stools and in the intestinal contents immediately after death. In the
ute and chronic forms ulcers are present in the mucosa; the coats of
testine are greatly thickened; at times large sloughs of mucous mem-
partly detached, occur, and the lesions are confined to the large
ine. Amoebae are more commonly present in these cases but are
le as to actual occurrence and numbers. Large hepatic abscesses,
y single, were encountered in a number of these cases. Amoebae
variable in the contents of the abscesses. In one very large abscess,
ying both right and left lobes of the liver, no amoebae but a pure
e of the Staphylococcus pyogenes citreus was obtained. The clinical
of the cases of dysentery with reference to amoebae was equally un-
ctory. In cases with marked symptoms both in patients confined
and those beginning to go about but still with persistent loose bowels,
organisms were frequently missed; while in instances ready to be dis-
ed they might, at certain examinations, be found to be very abundant.
rphology, the amoebae studied corresponded with the amoeba coli found
ypt and in this country. The bacteriological study of cases of dysen-
as carried out upon the fresh stools of acute and chronic cases and with
testinal contents, mesenteric glands, liver, etc., of cases dying and sub-
to autopsy. The intestinal flora was studied in its entirety by means
te cultures. A variety of microorganisms were separated. Many of
were well-known species or occurred normally in the situations
ich found. Tests with blood sera for agglutination were made
hose organisms giving positive reactions were separated for further
Two groups of bacilli were thus differentiated: (1) Having
ies with the group of bacillus coli communis. The agglutina-
was variable, being constant and sensitive with the blood-serum
same individual (host) and inconstant, and active in relatively
solutions only, in serum from other individuals. (2) Having
ies with the group of bacilli of which the Bacillus typhosus is the
Agglutination constant and sensitive with blood-serum of host as
s the sera of other individuals suffering from dysentery. Inactive
normal serum, serum from cases of typhoid fever, malaria and beri-
A bacillus belonging to the second group, which is still under study,
seem to agree with the bacillus dysenteriae isolated by Shiga from
of endemic dysentery occurring in Japan. It is regarded by us as
portant factor in the causation of the dysentery of the Philippine
ls. Experiments in immunization of animals and the production of
e are in progress. (b) *Typhoid Fever.* The total number of cases
phoid fever in the hospitals during May, June and July was far
those of dysentery; the number of deaths also was less. It was,
er, a frequent affection among Americans. The examination of the
microscopically and with the Widal test, was of the greatest help
gnosis. The disease came to autopsy presenting the classical in-
al lesions and also in atypical forms. In the small number of
ies made upon those dead of this disease, several instances of slight
inal involvement or even entire escape were met with. These cases
have remained very obscure or even undetermined except for the
l reaction and bacteriological examination. In some instances the
id bacillus was found widely disseminated throughout the body, the
y being made immediately after death. (c) *Malarial Fevers.* A large
rtion of the cases sent in from the field and outlying military stations
examinations had to be hastily made as instances of "malaria" or
rmittent fever" turned out to be cases of other diseases (typhoid
dysentery, etc.). A number of true cases of malarial fever were,
er, met with, and in the blood of these the characteristic parasites,
cal with those occurring in other places in which studies of the blood
been made, were found. No quartan parasites were met with, but
of quartan affection doubtless exist. Typical infections with the
an" and "aestivo autumnal" varieties of the parasite were en-
ered by us, and by microscopists among the Army physicians in the
ve Hospitals and on the *Relief.* One of the fatal cases of malaria
omplicated with acute lobar pneumonia. The cases of "calentura
iosa" which occur in Mindoro, Mindanao and in certain parts of
should be studied as soon as these regions are accessible. The
pelago is favorable also for the study of the relation of mosquitos and other insects to malarial infection. Some of the malarial cases were undoubtedly *recidives*, imported from Cuba or elsewhere. A very small number of deaths was referable to malaria. Two instances of acute malarial infection came to us for autopsy. On the other hand, several instances of malarial pigmentations of the organs, in persons dying from other diseases, were encountered. Parasites in the latter cases were absent. These men had, as a rule, been in Cuba or Porto Rico during the Spanish war.

(d) *Tuberculosis.* A number of cases of pulmonary tuberculosis developed among the soldiers in the American troops. A definite history of exposure to wet and various hardships was elicitable in many of these cases.

(e) *Dengue.* At Cavite there occurred a large outbreak of an epidemic fever of short duration (a few days) known locally as Cavite fever. Almost all who remained in Cavite for any length of time were attacked. Second and third attacks were common. Muscular pains were severe in some cases and not in others. A slight exanthem was present in many of the cases. Flushing of the face, restlessness and general malaise accompanied the fever and rapid heart action. Malarial parasites were not present in the blood, nor did the serum from such cases agglutinate cultures of the typhoid bacillus. The epidemic is regarded as one of Dengue.

(f) *Tropical Ulcers.* A number of the American soldiers suffered from a form of indolent ulceration, locally known as "tropical ulcer." These ulcers occurred singly sometimes but were more often multiple. They began as small pustules, which gradually extended. They were most frequent among those who had been compelled to make long marches through swampy districts, and the patients themselves attributed the ulceration to "poisoning" in the marshes.

(g) *Wound Infection.* Our experience with wound infections was rather limited. The other problems undertaken, regarded as more important as bearing on the general question of disease and its causation in the Islands, left but little time and opportunity to attack this interesting subject. Certain observations of interest were made. Pyogenic infections due to the common pus cocci occurred. In a small number of gun-shot wounds causing compound fractures emphysematous gangrene occurred and the bacillus aerogenes capsulatus was isolated. In one instance of compound fracture of the tibia a spore-bearing bacillus was associated with the bacillus aerogenes capsulatus. It was found in cover-slip preparations from the original wound and in the first set of cultures. It could not be further transplanted and hence was not identified. In two other cases was the bacillus aerogenes met with, one a case of peritonitis following infection of the intestine from an incarcerated hernia, and the other also a case of peritonitis but secondary to perforation of a typhoid ulcer of the intestine. The army surgeons were enthusiastic as to the adequacy of the "First-Aid Package" in limiting the number of wound infections.

CLIMATOLOGICAL AND HYGIENIC CONDITIONS.

The climate is that of continual summer. There is a wet season (S. W. Monsoon) and a dry season (N. E. Monsoon). The hottest period is at the end of the dry and the beginning of the wet season—precisely the period of our visit. The climate from November to March is said to be delightful. In the worst season of the year the climate is very trying and especial precautions are to be taken if Americans are to keep well there. The extremes of temperature are not great, but the constancy of the high temperature, together with a high degree of humidity, make the climate peculiarly enervating. We were interviewed at length while in Manila, officially by the U. S. Philippine Commission, with regard to climate and the hygienic precautions to be observed, as well as with regard to other medical problems in the islands. The climatic conditions and the hygienic precautions to be taken will form the subject of a fuller report to be made later.

The above represents, briefly stated, the results achieved by your expedition sent to the Philippines. As will be patent to you, not a little yet remains to be done before the scientific portion of the work is completed. This portion of the report is for the present only hinted at or withheld until it shall have been finished. It is the intention of your commissioners to make careful studies of the material relating to beri-beri, dysentery, malarial and typhoid fevers, leprosy, and the bubonic plague, which has been collected. These studies, with the exception of that relating to dysentery, will be carried out upon preserved material, and the labor involved, which has been divided between Baltimore and Philadelphia, will necessitate that some time must elapse before the finished report is forthcoming. The task of completing the study of the bacillus isolated from cases of dysentery has been assigned to Dr. Flexner, who was principally engaged with that theme during the residence in Manila. In order to carry out the experiments as designed, an outlay for experimental animals and their maintenance will need to be made. It is known to you that the original sum so generously contributed by friends of the University and appropriated for the use of your commission has been exhausted, and that private means have been drawn upon to defray a part of the expense involved. We would respectfully draw attention to this fact and to the further expenses to be incurred, and request direction as to your wishes regarding these matters.

We wish to express our deep gratitude to Messrs. Flint and Gay, whose untiring efforts during our residence in Manila made it possible to accomplish far more than we could have done unaided. It is a pleasure to acknowledge also many kindnesses on the part of Mr. John W. Garrett.

That we are deeply indebted to the officers in the Medical Service of the U. S. Army and Navy for opportunities and aid is evident from the report preceding. Courtesies and kindnesses extended by various citizens of Manila, European and native, are here also gratefully acknowledged.

Very respectfully,

Simon Flexner,
Lewellys F. Barker.

PROCEEDINGS OF SOCIETIES.

Scientific Association.

December 21, 1899.—One hundred and forty-sixth regular meeting. Professor Remsen in the chair.

Papers read:

The Diseases of the Philippine Islands. By L. F. Barker.

The Inheritance of Deafness. By W. K. Brooks.

January 10, 1900.—The annual business meeting, at which the following officers were elected:

President.—Ira Remsen.

Vice-President.—W. K. Brooks.

Secretary.—J. Elliott Gilpin.

January 18.—One hundred and forty-seventh regular meeting. Professor Remsen in the chair.

Paper read:

The Life of James Dwight Dana. By D. C. Gilman.

January 29.—One hundred and forty-eighth regular meeting.

Address by Professor R. W. Wood, of the University of Wisconsin. "Photographs of Sound Waves," and "Color Photography."

February 15.—One hundred and forty-ninth regular meeting. Professor Remsen in the chair.

Papers read:

Permanganic Acid by Electrolysis. By J. C. Olsen.

The Physical and Chemical Properties of Radio-active substances. By W. J. A. Bliss and C. E. Caspari.

Philological Association.

October 20, 1899.—One hundred and seventy-sixth regular meeting. Professor Gildersleeve in the chair. Forty members were present.

Papers read:

Some Observations on the Latinity of Seneca. By M. C. Sutphen.

On the Sanskrit Original of the Pranou Oupnekhat in the Persian Translation of the Upanişads. By M. Bloomfield.

November 17.—One hundred and seventy-seventh regular meeting. Professor Gildersleeve in the chair. Thirty-eight members were present.

Papers read:

The Text of Goethe's Faust. By H. Wood.

The Scansion of Glyconic and Kindred Verse. By C. W. E. Miller.

December 15.—One hundred and seventy-eighth regular meeting. Professor Gildersleeve in the chair. Thirty-three members were present.

[illegible] read:

[illegible] Treatment of Classical Stories—Chiefly Ovidian—in Certain [illegible]bethan Narrative Poems. By G. D. Brown.

The Recently-Discovered Inscription of the Roman Forum. B L. Wilson.

January 19, 1900.—One hundred and seventy-ninth regular meet Professor Gildersleeve in the chair. Thirty-five members were pre

Papers read:

On the Use of the Deus ex Machina, especially by Euripides. B B. Foster.

On a Passage in the Great Inscription of Beni Hassan. By C. J ston.

February 16.—One hundred and eightieth regular meeting. Prof Gildersleeve in the chair. Forty-two members were present.

Papers read:

The Origin of Mosaic Ritual. By P. Haupt.

The Relation of Egyptian and Semitic. By C. Johnston.

The Double Accentuation of the Decalogue. By K. J. Grimm.

The Opening Chapter of Deutero-Isaiah. By F. R. Blake.

The Biblical Ephod. By T. C. Foote.

A Modern Cuneiform Congratulatory Message. By W. B. McPhe

Historical and Political Science Association.

October 6.—Vacation Experiences.

October 20.

Municipal History of Cleveland, Ohio. By C. Snavely.

Recent Literature on Africa. By W. S. Drewry.

England and the Transvaal in International Law. By J. G. White

November 3.

The International Congress of Diplomatic History. By J. G. We ley.

The Archives of the United States. By J. M. Callahan.

England and the Transvaal. A review of recent literature and re events. By W. S. Myers.

November 17.

The Social Condition of the Southern Slave. By J. C. Ballagh.

The Disestablishment of the Church of England. By J. C. Ayer.

Review of Articles on the "Anglican Church Crisis." By B. Ki

Smart's "Theory of Distribution." By G. Cator.

Eaton's "Government of Municipalities." By E. C. Johnson.

December 8, 1899.—The Millennial Anniversary of Alfred the Great J. M. Vincent.

December 15.

Recent Banking Legislation in Germany. By S. Sherwood.

Financial Provisions of the "Overstreet Bill." By J. H. Holland

The Banking Provisions of the "Overstreet Bill." By G. E. Barne

January 5, 1900.

Report on the meeting of the American Economic Association. S. Sherwood.

Report on the meeting of the American Historical Association. J. M. Vincent.

January 19.

The Trust Conference in Chicago, September, 1899. By George Gaither, Jr.

The Economists and the Trusts. By G. Cator.

The Trusts from the Standpoint of the Bar. By I. A. Thorson.

Labor and Trusts. By V. E. Smith.

The Trust and the Farmer. By W. E. Martin.

Socialism and the Trusts. By B. Kilby.

February 3.—The Peace Conference at the Hague. By F. W. Holls

February 16.—The Economic Interpretation of History. By Simon Patten.

Recent Literature on Africa. By W. S. Myers.

Reinsch, English Common Law in the American Colonies. By R Mulford.

Maitland's Roman Canon Law in the English Church. By J. C. Ay

Woodward's Expansion of the British Empire. By G. L. Radclif

Cloete, The Great Boer Trek. By J. W. Harry.

THE HIGHEST AIM OF THE PHYSICIST.

ADDRESS BEFORE THE PHYSICAL SOCIETY OF AMERICA BY ITS PRESIDENT, PROFESSOR HENRY A. ROWLAND.[1]

and Fellow Physicists of America: We meet to-day on an occa-
narks an epoch in the history of physics in America; may the
that it also marks an epoch in the history of the science which
is organized to cultivate! For we meet here in the interest
which above all sciences deals with the foundation of the Uni-
he constitution of matter from which everything in the Uni-
e and with the ether of space by which alone the various
matter forming the Universe affect each other even at such
we may never expect to traverse, whatever the progress of our
e future.

have devoted our lives to the solution of problems connected
, now meet together to help each other and to forward the
the subject which we love. A subject which appeals most
he better instincts of our nature and the problems of which
ds to the limit of their capacity and suggest the grandest and
of which they are capable.

try where the doctrine of the equal rights of man has been
mean the equality of man in other respects, we form a small
body of men, a new variety of the human race as one of our
ntists calls it, whose views of what constitutes the greatest
in life are very different from those around us. In this respect
aristocracy, not of wealth, not of pedigree, but of intellect and
lding him in the highest respect who adds the most to our
r who strives after it as the highest good.

meet together for mutual sympathy and the interchange of
and may we do so ever with appreciation of the benefits to
d possibly to our science. Above all, let us cultivate the idea
ty of our pursuit so that this feeling may sustain us in the
orld which gives its highest praise, not to the investigation in
erial physics which our Society is formed to cultivate, but to
uses it for satisfying the physical rather than the intellectual
nkind. He who makes two blades of grass grow where one
is the benefactor of mankind; but he who obscurely worked
laws of such growth is the intellectual superior as well as the
factor of the two.

ds our country, then, in this respect? My answer must still
was fifteen years ago, that much of the intellect of the country
d in the pursuit of so-called practical science which ministers
ical needs and but little thought and money are given to the
tion of the subject which appeals to our intellect alone. But
ce here gives evidence that such a condition is not to last

he past we have a few names whom scientists throughout the
t to honor. Franklin, who almost revolutionized the science
by a few simple but profound experiments. Count Rumford,
iments almost demonstrated the nature of heat. Henry, who
done much for the progress of physics had he published more
ults of his investigations. Mayer, whose simple and ingenious
have been a source of pleasure and profit to many. This is
list of those whom death allows me to speak of and who have
ion here by doing something for the progress of our science.
record has been searched for more than a hundred years.
nt had I started to record those who have made useful and
ventions!

w, when I look in the faces of those before me, where the eager
high purpose sit enthroned on bodies possessing the vigor and
outh, that the writer of a hundred years hence can no longer
a reproach upon our country. Nor can we blame those who
efore us. The progress of every science shows us the condi-
rowth. Very few persons, if isolated in a semi-civilized land,
the desire or the opportunity of pursuing the higher branches
Even if they should be able to do so, their influence on their science depends upon what they publish and make known to the world. A hermit philosopher we can imagine might make many useful discoveries. Yet, if he keeps them to himself, he can never claim to have benefited the world in any degree. His unpublished results are his private gain, but the world is no better off until he has made them known in language strong enough to call attention to them and to convince the world of their truth. Thus, to encourage the growth of any science, the best thing we can do is to meet together in its interest, to discuss its problems, to criticize each other's work and, best of all, to provide means by which the better portion of it may be made known to the world. Furthermore, let us encourage discrimination in our thoughts and work. Let us recognize the eras when great thoughts have been introduced into our subject, and let us honor the great men who introduced and proved them correct. Let us forever reject such foolish ideas as the equality of mankind and carefully give the greater credit to the greater man. So, in choosing the subjects for our investigation, let us, if possible, work upon those subjects which will finally give us an advanced knowledge of some great subject. I am aware that we cannot always do this; our ideas will often flow in side channels; but, with the great problems of the universe before us we may sometime be able to do our share toward the greater end.

What is matter; what is gravitation; what is ether and the radiation through it; what is electricity and magnetism; how are these connected together and what is their relation to heat? These are the greater problems of the universe. But many infinitely smaller problems we must attack and solve before we can even guess at the solution of the greater ones.

In our attitude toward these greater problems how do we stand and what is the foundation of our knowledge?

Newton and the great array of astronomers who have succeeded him have proved that, within planetary distances, matter attracts all others with a force varying inversely as the square of the distance. But what sort of proof have we of this law? It is derived from astronomical observations on the planetary orbits. It agrees very well within these immense spaces; but where is the evidence that the law holds for smaller distances? We measure the lunar distance and the size of the earth and compare the force at that distance with the force of gravitation on the earth's surface. But to do this we must compare the matter in the earth with that in the sun. This we can only do by *assuming* the law to be proved. Again, in descending from the earth's gravitation to that of two small bodies, as in the Cavendish experiment, we *assume* the law to hold and deduce the mass of the earth in terms of our unit of mass. Hence, when we say that the mass of the earth is 5½ times that of an equal volume of water, we *assume* the law of gravitation to be that of Newton. Thus, a proof of the law from planetary down to terrestrial distances is physically impossible.

Again, that portion of the law which says that gravitational attraction is proportional to the quantity of matter, which is the same as saying that the attraction of one body by another is not affected by the presence of a third, the feeble proof that we give by weighing bodies in a balance in different positions with respect to each other cannot be accepted on a larger scale. When we can tear the sun into two portions and prove that either of the two halves attracts half as much as the whole, then we shall have a proof worth mentioning.

Then as to the relation of gravitation and time, what can we say? Can we for a moment suppose that two bodies moving through space with great velocities have their gravitation unaltered? I think not. Neither can we accept Laplace's proof that the force of gravitation acts instantaneously through space, for we can readily imagine some compensating features unthought of by Laplace.

How little we know, then, of this law, which has been under observation for two hundred years!

Then as to matter itself, how have our views changed and how are they constantly changing. The round, hard atom of Newton, which God alone could break into pieces, has become a molecule composed of many atoms, and each of these smaller atoms has become so elastic that after vibrating 100,000 times its amplitude of vibration is scarcely diminished. It has become so complicated that it can vibrate with as many thousand notes. We cover the atom with patches of electricity here and there, and make of it a system compared with which the planetary system, nay, the universe itself, is simplicity. Nay, more: some of us even claim the power, which Newton attributed to God alone, of breaking the atom into smaller pieces whose size is left to the imagination. Where, then, is that person who ignorantly sneers at the study of matter as a material and gross study? Where, again, is that man with gifts so God-like and mind so elevated that he can attack and solve its problem?

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[1] livered at the meeting in New York, October 28, 1899. Reprinted from the
nal of Science, December, 1899.

To all matter we attribute two properties, gravitation and inertia. Without these two matter cannot exist. The greatest of the natural laws states that the power of gravitational attraction is proportional to the mass of the body. This law of Newton, almost neglected in the thoughts of physicists, undoubtedly has vast import of the very deepest meaning. Shall it mean that all matter is finally constructed of uniform and similar primordial atoms, or can we find some other explanation?

That the molecules of matter are not round, we know from the facts of crystallography and the action of matter in rotating the plane of polarization of light.

That portions of the molecules and even of the atoms are electrically charged, we know from electrolysis, the action of gases in a vacuum tube and from the Zeeman effect.

That some of them act like little magnets, we know from the magnetic action of iron, nickel and cobalt.

That they are elastic, the spectrum shows, and that the vibrating portion carries the electrified charge with it is shown by the Zeeman effect.

Here, then, we have made quite a start in our problem: but how far are we from the complete solution? How can we imagine the material of which ordinary or primordial atoms are made, dealing, as we do, only with aggregation of atoms alone? Forever beyond our sight, vibrating an almost infinite number of times in a second, moving hither and yon with restless energy at all temperatures beyond the absolute zero of temperature, it is certainly a wonderful feat of human reason and imagination that we know as much as we do at present. Encouraged by these results, let us not linger too long in their contemplation, but press forward to the new discoveries which await us in the future.

Then as to electricity, the subtile spirit of the amber, the demon who reached out his gluttonous arms to draw in the light bodies within his reach, the fluid which could run through metals with the greatest ease, but could be stopped by a frail piece of glass! Where is it now? Vanished, thrown on the waste heap of our discarded theories to be replaced by a far nobler and exalted one of action in the ether of space.

And so we are brought to consider that other great entity—the ether: filling all space without limit, we imagine the ether to be the only means by which two portions of matter distant from each other can have any mutual action. By its means we imagine every atom in the universe to be bound to every other atom by the force of gravitation and often by the force of magnetic and electric action, and we conceive that it alone conveys the vibratory motion of each atom or molecule out into space to be ever lost in endless radiation, passing out into infinite space or absorbed by some other atoms which happen to be in its path. By it all electromagnetic energy is conveyed from the feeble attraction of the rubbed amber through the many thousand horse-power conveyed by the electric wires from Niagara to the mighty rush of energy always flowing from the sun in a flood of radiation. Actions feeble and actions mighty from intermolecular distances through interplanetary and interstellar distances until we reach the mighty distances which bound the Universe—all have their being in this wondrous ether.

And yet, however wonderful it may be, its laws are far more simple than those of matter. Every wave in it, whatever its length or intensity, proceeds onwards in it according to well known laws, all with the same speed, unaltered in direction from its source in electrified matter, to the confines of the Universe unimpaired in energy unless it is disturbed by the presence of matter. However the waves may cross each other, each proceeds by itself without interference with the others.

So with regard to gravitation, we have no evidence that the presence of a third body affects the mutual attraction of two other bodies, or that the presence of a third quantity of electricity affects the mutual attraction of two other quantities. The same for magnetism.

For this reason the laws of gravitation and of electric and magnetic action including radiation are the simplest of all laws when we confine them to a so-called vacuum, but become more and more complicated when we treat of them in space containing matter.

Subject the ether to immense electrostatic, magnetic or gravitational forces and we find absolutely no signs of its breaking down or even of change of properties. Set it into vibration by means of an intensely hot body like that of the sun and it conveys many thousand horse-power for each square foot of surface as quietly and with apparently unchanged laws as if it were conveying the energy of a tallow dip.

Again, subject a millimeter of ether to the stress of many thousand, nay even a million, volts and yet we see no signs of breaking down.

Hence the properties of the ether are of ideal simplicity and lead to the simplest of natural laws. All forces which act at a distance, always obey the law of the inverse square of the distance, and we have also the attraction of any number of parts placed near each other equal to the arithmetical sum of the attractions when those parts are separated. So also the simple law of etherial waves which has been mentioned above.

At the present time, through the labors of Maxwell supplemented by those of Hertz and others, we have arrived at the great generalization that all wave disturbances in the ether are electromagnetic in their nature. We know of little or no etherial disturbance which can be set up by the motion of matter alone: the matter must be electrified in order to have sufficient hold on the ether to communicate its motion to the ether. The Zeeman effect even shows this to be the case where molecules are concerned and when the period of vibration is immensely great. Indeed the experiment on the magnetic action of electric convection shows the same thing. By electrifying a disc in motion it appears as if the disc holds fast to the ether and drags it with it, thus setting up the peculiar etherial motion known as magnetism.

Have we not another case of a similar nature when a huge gravitational mass like that of the earth revolves on its axis? Has not matter a feeble hold on the ether sufficient to produce the earth's magnetism?

But the experiment of Lodge to detect such an action apparently showed that it must be very feeble. Might not his experiment have succeeded had he used an electrified revolving disc?

To detect something dependent on the relative motion of the ether and matter has been and is the great desire of physicists. But we always find that, with one possible exception, there is always some compensating feature which renders our efforts useless. This one experiment is the aberration of light, but even here Stokes has shown that it may be explained in either of two ways: first, that the earth moves through the ether of space without disturbing it, and second, if it carries the ether with it by a kind of motion called irrotational. Even here, however, the amount of action probably depends upon *relative* motion of the luminous source to the recipient telescope.

So the principle of Döppler depends also on this relative motion and is independent of the ether.

The result of the experiments of Foucault on the passage of light through moving water can no longer be interpreted as due to the partial movement of the ether with the moving water, an inference due to imperfect theory alone. The experiment of Lodge, who attempted to set the ether in motion by a rapidly rotating disc, showed no such result.

The experiment of Michelson to detect the etherial wind, although carried to the extreme of accuracy, also failed to detect any relative motion of the matter and the ether.

But matter with an electrical charge holds fast to the ether and moves it in the manner required for magnetic action.

When electrified bodies move together through space or with reference to each other we can only follow their mutual actions through very slow and uniform velocities. When they move with velocities comparable with that of light, equal to it or even beyond it, we calculate their mutual actions or action on the ether only by the light of our imagination unguided by experiment. The conclusions of J. J. Thomson, Heaviside and Hertz are all results of the imagination and they all rest upon assumptions more or less reasonable but always assumptions. A mathematical investigation always obeys the law of the conservation of knowledge: we never get out more from it than we put in. The knowledge may be changed in form, it may be clearer and more exactly stated, but the total amount of the knowledge of nature given out by the investigation is the same as

. Hence we can never predict the result in the case of
d our reach, and such calculations as the velocity of the
m their electromagnetic action has a great element of un-
we should do well to remember.

it comes to exact knowledge, the limits are far more cir-

en, that we hear physicists and others constantly stating
en beyond these limits? Take velocities, for instance,
a material body moving with the velocity of light. There
cess by which such a velocity can be obtained even though
rom an infinite distance upon the largest aggregation of
Universe. If we electrify it, as in the cathode rays, its
changed that the matter properties are completely masked
agnetic.

on error which young physicists are apt to fall into to
urve or a mathematical expression for given experimental
to apply it to points outside those limits. This is some-
rapolation. Such a process, unless carefully guarded, ceases
ng process and becomes one of pure imagination specially
hen the distance is too great.

ny purpose to enter into detail. What I have given suffices
ttle we know of the profounder questions involved in our

us fact that, having minds tending to the infinite, with
limited by time and space, the limits of our exact knowl-
mall indeed. In time we are limited by a few hundred or
d years: indeed the limit in our science is far less than
these periods. In space we have exact knowledge limited
our earth's surface and a mile or so below the surface,
what little we can learn from looking through powerful
the space beyond. In temperature our knowledge extends
bsolute zero to that of the sun, but exact knowledge is far
In pressures we go from the Crookes vacuum still contain-
flying atoms to pressures limited by the strength of steel
ninute compared with the pressures at the center of the
where the hardest steel would flow like the most limpid
cities we are limited to a few miles per second. In forces
tons to the square inch. In mechanical rotations to a few
per second.

which we have considered, the liability to error in what-
re go, the infirmity of our minds in their reasoning power,
of witnesses and experimenters, lead the scientist to be
cal with reference to any statement made to him or any
edge which may be brought to his attention. The facts
our science are so much more certain than those of history,
y of ordinary people on which the facts of ordinary history
lence rest, or of the value of medicines to which we trust
l, indeed to the whole fabric of supposed truth by which an
guides his belief and the actions of his life, that it may
and strange if what I have said of the imperfections of the
hysics is correct. How shall we regulate our minds with
here is only one way that I know of and that is to avoid
y of the ordinary, indeed the so-called cultivated legal mind.
ch thing as absolute truth and absolute falsehood. The
should never recognize the perfect truth or the perfect false-
posed theory or observation. It should carefully weigh the
h and error and grade each in its proper position along the
olute truth and absolute error.

crude mind has only two compartments, one for truth and
indeed the contents of the two compartments are sadly
cases: the ideal scientific mind, however, has an infinite
theory or law is in its proper compartment indicating the
ts truth. As a new fact arrives the scientist changes it from
nt to another so as, if possible, to always keep it in its proper
and error. Thus the fluid nature of electricity was once in
near the truth. Faraday's and Maxwell's researches have now
ve it to a compartment nearly up to that of absolute error.
f gravitation within planetary distances is far toward abso-
may still need amending before it is advanced farther in

The ideal scientific mind, therefore, must always be held in a state of balance which the slightest new evidence may change in one direction or another. It is in a constant state of scepticism, knowing full well that nothing is certain. It is above all an agnostic with respect to all facts and theories of science as well as to all other so-called beliefs and theories.

Yet it would be folly to reason from this that we need not guide our life according to the approach to knowledge that we possess. Nature is inexorable; it punishes the child who unknowingly steps off a precipice quite as severely as the grown scientist who steps over, with full knowledge of all the laws of falling bodies and the chances of their being correct. Both fall to the bottom and in their fall obey the gravitational laws of inorganic matter, slightly modified by the muscular contortions of the falling object but not in any degree changed by the previous belief of the person. Natural laws there probably are, rigid and unchanging ones at that. Understand them and they are beneficent: we can use them for our purposes and make them the slaves of our desires. Misunderstand them and they are monsters who may grind us to powder or crush us in the dust. Nothing is asked of us as to our belief: they act unswervingly and we must understand them or suffer the consequences. Our only course, then, is to act according to the chances of our knowing the right laws. If we act correctly, right; if we act incorrectly, we suffer. If we are ignorant, we die. What greater fool, then, than he who states that belief is of no consequence provided it is sincere?

An only child, a beloved wife, lies on a bed of illness. The physician says that the disease is mortal; a minute plant called a microbe has obtained entrance into the body and is growing at the expense of its tissues, forming deadly poisons in the blood or destroying some vital organ. The physician looks on without being able to do anything. Daily he comes and notes the failing strength of his patient and daily the patient goes downward until he rests in his grave. But why has the physician allowed this? Can we doubt that there is a remedy which shall kill the microbe or neutralize its poison? Why, then, has he not used it? He is employed to cure but has failed. His bill we cheerfully pay because he has done his best and given a chance of cure. The answer is *ignorance*. The remedy is yet unknown. The physician is waiting for others to discover it or perhaps is experimenting in a crude and unscientific manner to find it. Is not the inference correct, then, that the world has been paying the wrong class of men? Would not this ignorance have been dispelled had the proper money been used in the past to dispel it? Such deaths some people consider an act of God. What blasphemy to attribute to God that which is due to our own and our ancestors' selfishness in not founding institutions for medical research in sufficient number and with sufficient means to discover the truth. Such deaths are murder. Thus the present generation suffers for the sins of the past and we die because our ancestors dissipated their wealth in armies and navies, in the foolish pomp and circumstance of society, and neglected to provide us with a knowledge of natural laws. In this sense they were the murderers and robbers of future generations of unborn millions and have made the world a charnel house and place of mourning where peace and happiness might have been. Only their ignorance of what they were doing can be their excuse, but this excuse puts them in the class of boors and savages who act according to selfish desire and not to reason and to the calls of duty. Let the present generation take warning that this reproach be not cast on it, for it cannot plead ignorance in this respect.

This illustration from the department of medicine I have given because it appeals to all. But all the sciences are linked together and must advance in concert. The human body is a chemical and physical problem, and these sciences must advance before we can conquer disease.

But the true lover of physics needs no such spur to his actions. The cure of disease is a very important object and nothing can be nobler than a life devoted to its cure.

The aims of the physicist, however, are in part purely intellectual; he strives to understand the Universe on account of the intellectual pleasure derived from the pursuit, but he is upheld in it by the knowledge that the study of nature's secrets is the ordained method by which the greatest good and happiness shall finally come to the human race.

Where, then, are the greatest laboratories of research in this city, in this country, nay, in the world? We see a few miserable structures here and there occupied by a few starving professors who are nobly striving to do the best with the feeble means at their disposal. But where in the world is the institute of pure research in any department of science with an income of $100,000,000 per year. Where can the discoverer in pure science earn more than the wages of a day laborer or cook? But $100,000,000 per year is but the price of an army or a navy designed to kill other people. Just think of it, that one per cent. of this sum seems to most people too great to save our children and descendants from misery and even death!

But the twentieth century is near—may we not hope for better things before its end? May we not hope to influence the public in this direction?

Let us go forward, then, with confidence in the dignity of our pursuit. Let us hold our heads high with a pure conscience while we seek the truth, and may the American Physical Society do its share now and in generations yet to come in trying to unravel the great problem of the constitution and laws of the Universe.

PERCY TURNBULL MEMORIAL LECTURESHIP.

EIGHTH COURSE OF LECTURES.

A lectureship to treat of Poetry has been instituted in this University by the generosity of Mr. and Mrs. Lawrence Turnbull, of Baltimore, who thus commemorate the name of their son, Percy Graeme Turnbull, who died in 1887.

In accordance with the terms of the gift, a course of lectures may be expected annually from some one who has gained distinction as a writer of poetry or as a critical student of the poetic art.

The Trustees have the pleasure of announcing that the eighth course of lectures on this foundation will be given by C. H. HERFORD, Litt. D., Professor of the English Language and Literature in the University College of Wales, and author of "Studies in the Literary Relations of England and Germany in the Sixteenth Century" (1886); a translation of Ibsen's Brand, in the original metres, with introduction and notes (1893); "The Age of Wordsworth" (1897). He is also General Editor of the "Warwick Shakespeare," and of the "Warwick Library." He has recently completed the "Eversley Edition of the Works of Shakespeare," in ten volumes (Macmillan Company).

The subject of the course will be *English Poetry, viewed and interpreted in its principal periods.*

The lectures will be given in McCoy Hall, at 5 o'clock, beginning Monday, April 23, 1900.

The lectures will begin punctually and will close within the hour. The door will be closed after the lecture begins.

TOPICS.

NATURE AND ROMANCE IN ENGLISH POETRY.

April 23.—The Germanic Core of English Poets.
April 24.—The Age of Chaucer.
April 26.—The Renascence.
April 27.—The Elizabethans.
April 30.—The Seventeenth Century.
May 1.—The Return to Nature and the Revival of Romance.
I. From Pope to Blake.
May 3.— II. From Wordsworth to Tennyson.
May 4.—The Permanent Power of English Poetry.

PREVIOUS LECTURERS.

1891. EDMUND C. STEDMAN, LL. D., of New York,—"The Nature and Elements of Poetry."

1892. Professor RICHARD C. JEBB, LL. D., D. C. L., of the University of Cambridge,—"The Growth and Influence of Classical Greek Poetry."

1893. Professor ROBERT Y. TYRRELL, LL. D., Litt. D., of Trinity College, Dublin,—"The Growth and Influence of Latin Poetry."

1894. Professor CHARLES ELIOT NORTON, LL. D., D. C. L., of Harvard University,—"Dante."

1896. Professor GEORGE ADAM SMITH, D. D., of the Free Church College, Glasgow,—"Hebrew Poetry."

1897. M. FERDINAND BRUNETIÈRE, Editor of the "Revue des Deux Mondes,"—"French Poetry."

1898. Professor CHARLES R. LANMAN, Ph. D., of Harvard University, —"The Poetry of India."

CURRENT NOTES.

GEORGE HUNTINGTON WILLIAMS MEMORIAL LECTURES IN GEOLOGY.

Professor W. C. BRÖGGER, of the University of Christiania, the distinguished Norwegian geologist, has accepted an invitation to deliver the second course of the George Huntington Williams memorial lectures at the Johns Hopkins University, in April, 1900.

Professor Brögger is the most prominent Scandinavian geologist, and has published a series of memoirs upon the geology of Southern Norway that have given him rank among the leading investigators of his time. Professor Brögger comes as the successor in the Williams course to Sir Archibald Geikie, the Director-General of the Geological Surveys of Great Britain and Ireland, who opened the lectureship two years ago with a course upon The Founders of Geology. Professor Brögger will lecture upon Modern Deductions regarding the Origin of Igneous Rocks, a subject that has been commanding the attention of geologists in recent years.

LECTURES ON THE FOUNDERS OF THE REPUBLIC.

Professor JAMES SCHOULER, LL. D., of Boston, author of a "History of the United States under the Constitution," will deliver a course of biographical lectures on four of the great founders of the American Republic.

The lectures will be given Wednesdays and Fridays in the Donovan Room, McCoy Hall, at 5 p. m., and will be open to the public. The dates and special topics will be as follows: *March* 7.—Benjamin Franklin. *March* 9.—George Washington. *March* 14.—Alexander Hamilton. *March* 16.—Thomas Jefferson.

DONOVAN LECTURES, 1900.

Professor C. T. WINCHESTER, of Wesleyan University, Conn., will give a course of six lectures, on the Donovan foundation, his general subject being the *Essayists and Reviewers of the Beginning of the Nineteenth Century.* The course will begin on Wednesday, March 28, and will continue till Friday, April 6. The special topics will be: Introductory—The Reviews; Hazlitt; Lamb; Wilson; DeQuincey; Leigh Hunt.

Dr. G. STANLEY HALL, President of Clark University, gave ten lectures on Psychology and Education, in McCoy Hall, February 5–16.

ALBERT H. SMYTH, Professor of English in the Central High School of Philadelphia, gave a course of eighteen lectures on Modern English Literature, December 15 to February 17. The lectures were in three groups,—first, six lectures on Living English Writers; second, six lectures on the Lake Poets; third, six lectures on Burns and Scott.

Dr. FREDERICK M. WARREN, Professor of Romance Languages in Adelbert College, gave eight lectures on the Modern French Drama, January 23 to February 7.

FREDERICK W. HOLLS, of New York, Secretary and Counsel to the American Commissioners to the Peace Conference at the Hague in 1899, delivered two lectures on the work of the Conference, in McCoy Hall; the first (open to the public) on February 2, and the second (designed for students of historical and political science and of law) on February 3.

The Reverend Canon H. D. RAWNSLEY, of Keswick, England, who is a promoter of the society lately formed in England to preserve the shrines of literary and historical associations, addressed the students of the Johns Hopkins University on October 25.

In the Public Educational Course, of which a detailed announcement was given in the last *Circular*, courses by Dr. Shattuck and Dr. Fassig, in Geology and Meteorology; by Professor Ames, in Physics; by Dr. Jeffrey R. Brackett and Dr. J. H. Hollander, in Studies of the Modern City, have been in progress. The lectures of Professor Smyth, above noted, formed a part of this course. Single lectures were also given by Dr. James E. Russell, Dean of the Teachers College, New York, and by Dr. James McAlister, President of the Drexel Institute, Philadelphia.

NOTES IN PHILOLOGY.

On the Treatment of Classical Stories—Chiefly Ovidian—in Certain Elizabethan Narrative Poems.

By GEORGE DOBBIN BROWN.

[Abstract of a paper read before the University Philological Association, December 15, 1899.]

The poems considered were: Lodge's Glaucus and Scylla; Shakspere's Venus and Adonis; Shakspere's Lucrece; Marston's Pigmalion's Image; Gresham's Picture of Incest; Barksted's Myrrha, the mother of Adonis; Austin's Scourge of Venus; Marlowe's Hero and Leander; Chapman's continuation of Marlowe's Hero and Leander; Beaumont's Salmacis and Hermaphroditus.

Ovid, being at once the greatest story-teller of Rome, and the most fanciful, rhetorical, and Italian of Latin poets, was from these two characteristics especially dear to the Elizabethan heart, and influenced the poets of the day more than any other classical writer. Numberless passing references to classical stories prove their indebtedness to Ovid; but it is certain poems that come as a whole from his works which we are here particularly interested in.

Upon examination we find the Elizabethans' methods of using Ovidian stories to be extremely diverse, the only characteristic common to all the methods being freedom of treatment. Attempting to classify, we may say that this freedom of treatment may, on the one hand, consist in the expansion of elements already present in the source; or, on the other hand, it may be due to the addition of new features, and these new features may be either invented by the poet, or borrowed from some secondary source. Thus as methods of treatment we have Expansion, Original Addition, and Contamination, more than one of which are frequently followed in the same poem. As we might expect from the luxuriant nature of the Elizabethan period, the negative methods of Omission and Compression are far less prominent.

Ovid's story of Scylla's disdain for Glaucus is told with the greatest freedom of addition (and of thereby necessitated omission) by Lodge, who, with the evident desire of balancing off episode against episode, completes the poem with thorough-going original additions descriptive of the cured Glaucus's disdain of the wounded Scylla.

In Shakspere's Venus and Adonis we have a contamination of Ovid's stories of Venus and Adonis and of Salmacis and Hermaphroditus. Shakspere takes incidents from both tales and the inner spirit of the second (after which, however, he does not name his poem), and with great artistic success blends and expands them into an effectually new form.

In his Lucrece Shakspere borrows from both of the slightly different forms of the story as given by Livy and Ovid. The distinguishing characteristic of Shakspere's treatment is, however, expansion. In addition to the Virgilian elements in the Picture of Troy usually pointed out, attention must be called to a fact not noticed by the commentators,—that the scene which paints the Greeks and Trojans preparing for battle could have come only from Homer.

Marston in his Pigmalion's Image is chiefly concerned with the enlargement and excessive emphasis of sensual details, thus giving to Ovid's chaste enough story a very licentious turn.

Gresham's Picture of Incest amounts to little more than a metrical translation of Ovid's Cinyras and Myrrha story with the slight addition of short similes and proverbial sayings.

Barksted makes two important additions to Ovid's Cinyras and Myrrha story. I. He explains how Myrrha became inflamed with her criminal love. II. He gives an account of what happens during Myrrha's wandering in Panchæa. Both of the episodes have numerous reminiscences of Ovid, the second being indeed an Ovidian mosaic.

Austin, treating the same story, makes perhaps the most artistic contamination we have seen since Shakspere's Venus and Adonis, though of far more mechanical a nature. This contamination has been pointed out by Dr. Kirby Smith, and consists in the introduction of the dream and the letter from Ovid's Byblis story.

Marlowe's treatment of Musæus's Hero and Leander consists, in part, of very beautiful expansions. But far less satisfactory is the introduction at the end of the first sestiad of some original mythologizing, conceived along Ovidian lines. This interpolation, though in itself fairly well told, is out of place and interrupts the flow of the main story.

Equally ill-timed and less well composed interpolations, which their authors doubtless considered to be written in true Ovidian style, ruin Chapman's continuation of Marlowe, and seriously mar Beaumont's telling of Ovid's Salmacis and Hermaphroditus story.

An Ovidian passage which I believe has not before been pointed out as a source for Shakspere (though not in his narrative poetry) may be seen in Metam. xv. ll. 176–185 and ll. 214–236, which certainly gave rise to sonnet 60. If Shakspere knew these lines, he almost certainly knew the passages immediately preceding and following, and I would therefore suggest a connection between Metam. xv. ll. 153–175 and sonnet 59, and Metam. xv. ll. 239–258 and sonnets 44 and 45.

On the Use of the Deus ex Machina, especially by Euripides.

By H. B. FOSTER.

[Abstract of a paper read before the University Philological Association, January 19, 1900.]

The speaker took up first the well-worn ideas on the subject of Euripidean employment of machinery at the end of many dramas,—Schlegel's too scathing denunciation, Jacobs and Welcker in their more moderate statements,—and then passed on to the histories of Greek literature. Otfried Müller regards the device as showing that dramatic action had lost the power of natural development. Bernhardy rather believes in the theory of a knot. Bender mentions false economy in general. Jevons and Mahaffy think the action was cut off at both ends to allow the poet greater freedom in the body of the play. Sittl sees caprice on the part of gods, and a convenient tragic tool. Perry feels the appearance of divine beings to be necessary in the age of Euripides, if they were to receive any recognition of authority. Christ says the *deus* usually screens haste or lack of talent.

After this attention was called to Schrader's essay (limited to the subject in hand) in which he renders the special service of proving that only in the *Orestes* do matters come to such a pass that the situation is inextricable without divine intervention. His attempt to reconcile Euripides with Aristotle and Horace is not, however, so successful. A few minutes were devoted to Weil (who follows Schrader), and to the treatises of Kuhlenbeck and of Widemann (both from the scenic standpoint) and of Dühr, who tries to prove epic influence.

The speaker disagreed with Verrall's conclusion, that every god is a grotesque insincerity, and showed by an example or two how entirely usual is the general function of the divinities, and how the characters impute to them no extraordinary qualities. The ancient references to *deus ex machina* were next set forth,—Plato (Cratylus and Cleitophon), Antiphanes, Menander, Lucian, Demosthenes, Suidas, all of them, whether they spoke disparagingly or not, much later than Euripides.

Euripides was an artist. He found the *deus ex machina* already existing in the poems of Homer. The idea was a commonplace among ancient peoples; there are instances in the Old and New Testament, in the Sanskrit drama, and elsewhere. Euripides merely transferred it to the stage, showing everywhere, save in the *Orestes*, an evident predilection for it. To a believing audience the method is not essentially undramatic.

What the poet thought of the gods does not plainly appear from his writings. In every case the element of characterization must be deducted. Hence from many utterances, for and against, we can gather of personal feeling only a general notion of vast external forces, called now Zeus, now Fate, now Aether, which are pressing down upon dependent man. One who examines the speeches of the *dei ex machina* themselves finds in almost every one a manifestation of this irrevocable destiny. Such phrases as *πεπρωμένον γάρ ἐστιν, ἔστι μόρσιμον, μοῖρα Ζεύς τ' ἔκρανε* constantly occur. This sense of impending fate is everywhere an undercurrent of Greek life. It is the reason that the gods of Euripidean drama assign for their interference. The notion of fate is elsewhere in Euripides strong,—more striking than in Sophocles. The man himself, a moody recluse, had the temperament for it. Herein we see at all events an intelligible artistic motive for the god from the machine. He illustrates the futility of human endeavor.

The prophecies of the gods, subsequent to their appearance, were, the speaker proceeded, phenomena of a different category. They were apparently not the occasion of the divine advent, but rather an afterthought, introduced when the *deus* had completed the more practical part of his mission. The omniscient immortal lent himself to a convenient literary trick, by which, in a narrative relegated to some remote past, events are foretold which the hearers know to have been fulfilled. Virgil in his Aeneid (Book VI) employs this method to rehearse the glories of Rome, and modern poetry is by no means free from it.

The paper closed with a few general notes and a list of the situations in the various plays, to show the unexpected turn of affairs in each instance occasioned by the *deus ex machina*.

The Recently Discovered Inscription of the Roman Forum. By H. L. Wilson.

[Abstract of a paper read before the University Philological Association, December 15, 1899.]

The excavations carried on during the year 1899 in the Roman Forum, and particularly in the Comitium, have been of the highest importance. Most of all, the inscribed stele, which is roughly broken, apparently by the hand of man, at what is supposed to have been about the middle of its original height, has given rise to one of the most animated, not to say bitter, philological controversies of recent times, and continues even yet to excite the greatest interest. The first announcement of the discovery, together with photographic facsimiles and remarks by various scholars, appeared in *Notizie degli Scavi* for May, 1899. The text of the inscription, engraved in an archaic Greek alphabet, is a vertical *βουστροφηδόν*, the only example of the kind yet found on Italian soil. On this account the mutilation is alternately at the beginning and the end of the lines. Without considering Professor Ceci's wild assignment of the monument to the early regal period, we may regard it as certain that this is the oldest Latin record on stone, a record which in age is comparable only with the vase of Duenos and the *fibula Praenestina*.

To the grammarian the inscription is especially interesting in two points, namely, the words *sakros* and *iouxmenta*. It is well known that in *-ro-* stems, the final *-ros*, when preceded by a consonant, was changed by a phonetic process common to Latin with other Italic languages to *-er*, e. g. *ager* = **agro-s* (ἀγρός), Umb. *ager*. Hitherto this phonetic change has been regarded as consummated in a proto-Italic period: in the new inscription, however, we have the form *sakros*, which now stands in all the grammars with the asterisk as a non-attested form. *Iouxmenta*, which Ceci divides into *ioux menta* and explains by the aid of Umbrian *iuka* (*preces*), is nevertheless to be regarded as an equivalent of *iumenta*: whether as the earlier form which phonetically yielded *iumenta*, or as a secondary, analogical formation, or as a graver's error, is not easily decided. If the first, then support is given to the theory that in combinations of guttural + s + m (n), the guttural and s disappear. *Iouxmenta* is of course the same as *iougsmenta*, but *iouy(e)s-menta*, suggested in explanation by Ceci, is a philological monstrosity not to be considered for a moment.

The most sensible attempt at restoration and interpretation of the inscription is that offered without much confidence by Professor Comparetti in *Atene e Roma*, 1899, No. 10, 145-164. He regards the stele as a kind of signpost, with more than one inscription, intended to ward off trespassers and preserve the sacred enclosure from desecration. The probable date of the monument—about 400 B. C.,—was reached by Hülsen (*B. Ph. W.* 1899, Nos. 31, 32), and W. Otto (*Arch. Lat. Lex.*, XI, 436) independently, by the former on metrological, by the latter on linguistic grounds.

In spite of the labors of many scholars, we are still very far from comprehending this inscription, and it may be that, as in the case of the Duenos vase, no real consensus of opinion on the subject will ever be reached. If new light comes, it will probably come from the continued excavations in the Forum.

Note. Since the presentation of the paper which here appears in abstract, Giacomo Tropea has published in the *Rivista di storia antica*, IV, pp. 469-509, an excellent account of the discovery and the discussion of the monument up to the end of 1899 under the title "La Stele Arcaica del Foro Romano."

The Scansion of Glyconic and Kindred Verse. By C. W. E. Miller.

[Abstract of a paper read before the University Philological Association, November 17, 1899.]

The paper presented under the above title was essentially an adaptation of a review, since published in *A. J. P.*, XX. (1899), 331-3, of a recent treatise on Greek Rhythms and Metres. The author of this treatise had condemned the current mode of scansion of Glyconic and kindred verse and had proposed instead a radically different though not entirely new scansion. The proposed method was closely scrutinized and its difficulties and other objectionable features were pointed out, whereas the system now prevailing was defended as being essentially correct and in conformity with the laws of Greek rhythm enunciated on p. 125 of No. 32 (July, 1884) of these *Circulars*.

The Colloquial Element in Seneca. By M. C. Sutphen.

[Abstract of a paper read before the University Philological Association, October 20, 1899.]

To the student of his literary age Seneca may best be selected as the model for investigation. The criticism of his style and diction, the *cause célèbre* of antiquity, must be earnestly considered if we would know silver latinity.

Buecheler in a note in *Woelfflin's Archiv* was the first to raise his voice against unnecessary emendation in this author, pointing out the fact that the colloquial element in Seneca's works had been too little regarded. An investigation conducted with some minuteness, especially on the lexical side, justifies this opinion. Seneca uses a number of diminutives with the colloquial loss of the diminutive feeling, frequent instances occur of verbs unnecessarily compounded with *ad*, *con*, *de* and especially *ex*, and substitutions, such as *civitas* for *urbs*, *genus* for *modus*, *tam magnus* for *tantus*, are by no means uncommon. Especially noticeable is the great mass of proverbial and popular phraseology, by no means confined to the Apocolocyntosis, but appearing throughout his writings. Much of his latinity finds excellent parallels in the church fathers.

The *sermo cotidianus* is of course natural to comedy and is properly employed by Petronius in the speech of the parvenu Trimalchio[1] But, it may well be asked, why does so decided an element manifest itself in Seneca, a Stoic philosopher?

Teuffel, in his *Studien*, remarks that Persius, secure in his social position, used colloquialisms with much greater freedom than Horace, the son of a *libertinus*. The emperor Augustus, according to the statement of Suetonius, did not affect the purity of diction exhibited by Julius Cæsar. Seneca was similarly unrestricted in his choice of expression.

Again, by taking into consideration the Stoics, both Latin and Greek, we may fairly assume that strictness in style and language was not urged in this philosophic school. Diminutives are rampant, for the Stoic looking down from the lofty pinnacle of his virtue, held all mankind as poor little ants struggling in the sand-heap of an insignificant world. As practical philosophers—and sometimes politicians—they wanted their words to strike home. Take care of the words and the sense will take care of itself was their *dictum*. Such little things as the paltry restrictions of grammarian or purist could not bind the free unfettered soul of the Stoic.

A third element in the question we may style, the genius of his age. The study of silver latinity is no easy one,—the cross-currents of literary feelings and purposes may puzzle even the experienced navigator and much is still unnoted on the chart. It was the age of protest against former literary models and the broad smooth current of Cicero breaks up into the choppy waves of Seneca. Life, despite its artificiality, was the aim in manners and in literature. True to his age, Seneca found need of the *sermo cotidianus* equally with Horace in his laughing criticism, Persius and Juvenal in their invective or Martial in the biting epigram.

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[1] The freedom of satire likewise encouraged its use in that department.

I ZOOLOGICAL COLLECTING IN JAMAICA, W. I.

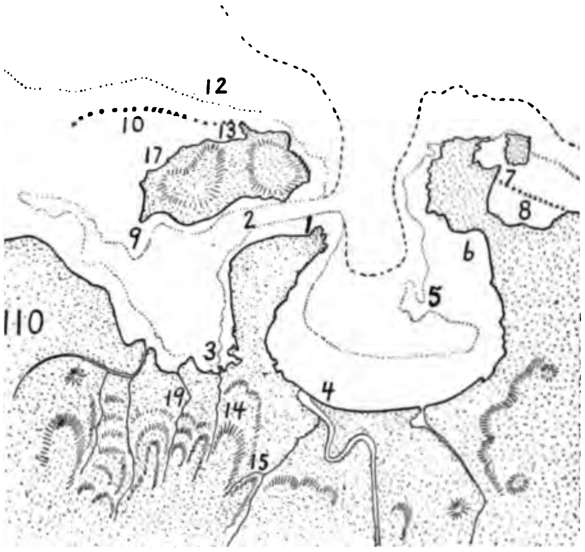
By Franklin Story Conant, Ph. D.

Edited by E. A. Andrews.

Marine laboratory of the Johns Hopkins University was
Port Antonio, Jamaica, W. I., in the Summer of 1897, the
3. Conant made, incidentally to his researches, some observa-
ıe fauna of that region. Though these notes are necessarily
imperfect it seems advisable to put them into print for the
seequent workers in that region, since experience has shown
t is welcome to one seeking material for research in a new

ɔd way these notes also indicate the contrast in marine fauna
; Antonio and Port Henderson, when compared with notes
atter station and published in these Circulars, Vol. XI, 1892,

Dr. Conant's notes we give: first, a list of the shore collecting
ɔcalities, most of which are indicated upon the accompanying
Port Antonio region; second, a recapitulation of the facts by
ıls found with figures to designate their distribution, as far as
ıe notes; and finally, some of Dr. Conant's records of surface
ɔllecting.
otherwise designated the animals were "common" at the
re collected.



I.

ıall reef off the end of Litchfield Point being most accessible
tory was most thoroughly investigated by wading at low tide,
l a good variety of forms.
lack, white yellow, purple, green, red and brown sponges.
.ibrunea neglecta, comparatively common though extremely
3. Condylactis passiflora, fairly common. Colour varieties of
crucifer. Discosoma anemone, few. Aiptasia annulata and
ida, numerous. An isolated form of Gemmaria? Millepora,
. A Stylaster? with red skeleton. *Vermes*, comparatively
tubicolous Polychætæ and of Turbellarians and Nemerteans.
.nous masses like those of Clymenella. *Echinodermata*, Cidaris
Diadema setosum, very common. Hipponoë esculenta, not
Echinometra subangularis. A small star-fish like Oreaster.
a, now and then. Chiridota rotifera?, rare. Holothuria
.mon. Mülleria sp.?, not common. Two species of Spatan-
ıpecies of Ophiurians and another star-fish, of undetermined
ɔllusca, Chiton, very abundant. A Fissurella, now and then.
Oliva? Small prosobranchs. An Octopus, rare. A small
Lamellibranch. Aplysia and two small nudibranchs. *Crus-*
ı, very common on shore rocks. Two other crabs. Alpheus
ıctylus. A small red decapod with chelæ on third pair of periopods. Stenopus hispidus. A decapod with white cephalothorax and red-yellow abdomen. Panularis americanus, several specimens. *Tunicata*, A long red Ascidia?, rare.

(2) Floating in the channel between Navy Island and Tichfield, off the Laboratory were taken an Aurelia-like Semostome in abundance. Also Charybdea Xaymacana, now and then. Appendicularia was also dipped up here.

(3) The Wharf of the Boston Fruit Company and its vicinity furnished Scolopendra-like centipedes and small millipedes, lizard eggs and snail eggs. There were also taken an Aurelia?, very abundant: marine gasteropods and sabella-like polychætæ.

(4) Along the beach of East Harbor, near West Town River chitons and a lamellibranch were common, as also a brown Hippa. Gelasimus occurred, but not common.

(5) In the shallow water on the East side of East Harbor were found: *Cœlenterata*, a tubularian hydroid and Aiptasia annulata. *Porifera*, a brown sponge. *Vermes*, two tubicolous Polychætæ. *Echinodermata*, Toxopneustes varieagatus, Cidaris Tribuloides? and, not common, Mülleria, Synapta lappa?, Mellita sexforis, Pentaceros reticulatus and an Asteroid. *Mollusca*, a lamellibranch. *Crustacea*, Calappa marmorata, quite often seen. *Tunicata*, a compound ascidian, not common.

(6) On the shallows of the North-East end of East Harbor were found: *Porifera*, purple, green, and brown sponges. *Cœlenterata*, tubularian hydroids not common, Aiptasia annulata. *Vermes*, a nemertean, a turbellarian and two polychætæ. *Echinodermata*, a spatangoid, rare, Synapta lappa?, two ophiuroids, not common, Diadema setosum, Echinometra subangularis, Toxopneustes varieagatus, not common, Hipponoë esculenta, Cidaris tribuloides and two or three clypeasteroids. *Mollusca*, a chiton, aplysia, a lamellibranch and some gasteropods. *Tunicata*, a compound ascidian.

(7) The channel and shores between Folly Point and Wood Island proved good collecting grounds: *Porifera*, white and yellow sponges. *Cœlenterata*, Physalia?, Condylactis passiflora, Aiptasia annulata, Aulactinia styloides, Actinoides pallida, Ricordea florida, Discosoma anemone, Palythoa sp., Zoanthus, Meandrina sp., Porites sp., Astrea, several species, Rhipidigorgia, with commensal opisthobranchs, Millipora, Alcyonaria and a red Stylasteroid. *Vermes*, a Sipunculoid and two Polychætæ. *Echinodermata*, Diadema setosum, Hipponoë esculenta, Cidaris tribuloides, not common, Echinometra subangularis, two spatangoids, not common, five ophiurids, Synapta lappa, Chiridota rotifera, Holothuria and an asteroid, not common. *Mollusca*, several species of Chiton, Fissurella sp ?, two nudibranchs, Aplysia, and an octopus, rare. *Crustacea*, Grapsus and several other crabs, Hippa, the white species, Gonodactylus sp.?, Alpheus sp.?, small red decapod with chelæ on the third pair of periopods.

(8) The shore "awash," East of Folly Point is a sandy shore with large patches of Posidonia and other plants and the water is sometimes muddy. It yielded only: *Cœlenterata*, Discosoma anemone, D. sp. n?, Aiptasia annulata, rare, Phellia sp., Bunodes granulatus, Asteractis sp. n.? rare, Actinophorus elegans, not common. *Echinodermata*, Chiridota, Echinometra subangularis, not common, an Ophiurid, Hipponoë esculenta. *Vermes*, Sabellaria? and sipunculoids; Mollusca, octopus; *Pisces*, Muraena sp. and conger eel.

(9) The Sand Bank and shallows, Southwest of Navy Island: *Porifera*, purple, green and red sponges. *Cœlenterata*, Aiptasia annulata and another sea anemone, Condylactis passiflora, a brownish yellow, horny hydroid, corals, Discosoma sp. n.? *Echinodermata*, a black species of Holothuria?, Mulleria?, not common, Synapta lappa? not common, Cidaris tribuloides?, Hipponoë esculenta. not common, Ophiocoma aethiops? a second species of Holothuria, Brissus. *Vermes*, a platode parasitic in Holothuria. *Mollusca*, Aplysia, not common, three species of conchs, Pinna and boat-shells. *Tunicata*, a Botryllus.

(10) Collected on the Coral Reef West of Navy Island: *Cœlenterata*, abundant corals, alcyonaria not very common, Stylaster?, Millepora, an anemone and the jelly-fish, Cassiopea. *Echinodermata*, Diadema setosum. Echinometra subangularis, Hipponoë esculenta, not common, Cidaris tribuloides, Synapta lappa and two forms of Ophiurids. *Crustacea*, a small Alpheus? in the rock, a Libinia-like crab, and rock-boring barnacles. *Teleostei*, small, bright-colored fish, more numerous and of more kinds than on the reefs off Kingston Harbor; one with pair of fins apparently transformed into creeping and attaching organs. *Vermes*, incrustations of shell-building Annelids, several Sabella-like and other polychætæ. *Mollusca*,

the common chiton and a smaller, "woolly" form, that is not common, a few fissurella and a pinna shell, one of the forms of conch and of octopus.

(11) "Blue Hole," a locality outside the limits of the accompanying sketch, proved a very favorable collecting region. *Porifera*, the yellow sponge. *Cœlenterata*, corals not very abundant. *Echinoderms*, Diadema setosum, Cidaris tribuloides, Echinometra subangularis, Hipponoë esculenta, Synapta lappa, and four species of Ophiurians. *Vermes*, several specimens of a sipunculoid and two polychætæ. *Mollusca*, conchs, not common, chiton, small prosobranchs, a clam resembling venus, land snails and eggs of slugs, a small species of Aplysia. *Crustacea*, hermit crabs, very common, Stenopus, hispidus. *Tracheata*, Phrynus, Centrurus insulans, with young, Peripatus, one specimen on the hill. *Pisces*, "tobacco-fish."

(12) Surface collecting in the open, Northwest of Navy Island: *Oscillatoriaceæ*, Trichodesmium erythræum, very abundant. *Protozoa*, a compound Radiolarian. *Cœlenterata*, Charybdea sp.? several Hydromedusæ sp.?, at least three kinds of Siphonophores, two forms of Planula larvæ, Ephyræ, one small anemone. *Vermes*, a few large Tornaria, four or five kinds of small Polychætæ, Sagitta flaccida, very abundant, S. tenuis and S. hispida, not common, Trochophores, not common, a few Planarians. *Mollusca*, Heteropods and Pteropods, shelled Gastropod veliger, not common. *Crustacea*, transparent Isopod?, Phyllosome larva of Palinuris, not common, Copepods, very large Lucifer, not common, small shrimp, Erichthus larvæ, Zoœa, Ostracods, Megalops, not frequent, "woolly larva" (zoœa?) *Tunicata*, Salpa and Doliolum, not common. *Teleostei*, fish eggs, not common, small pipe fish, small ribbon-like transparent form, Leptocephalus.

(13) Along North shore of Navy Island the following Echinodermata were found: Diadema setosum, two Spatangoid forms, one not common, five species of Ophiurid, Holothuria sp.?, two Asteroids, Chiridota rotifera.

(14) In the Old Church Yard were taken: *Crustacea*, Isopods. *Tracheata*, scorpions, not common, three kinds of Myriapods, cockroaches. *Mollusca*, land snails and large yellow slugs, not common. *Vermes*, Oligochætæ. *Reptilia*, lizards.

(15) Richmond Hill and fresh stream to the East: *Mollusca*, Gasteropods and large yellow slugs, not common. *Crustacea*, shrimps and fresh-water crabs. *Tracheata*, large black and small Chilognaths, a large, rare beetle. *Amphibia*, small tree-frogs. *Reptilia*, lizard eggs.

(16) A ravine on the Bog Estate above the Reservoir; not shown on the map: *Vermes*, a dark blue Oligochæte. *Mollusca*, slugs and three kinds of land snails. *Crustacea*, hermit crabs. *Tracheata*, scorpions and pseudoscorpions, several kinds of myriapods, phrynus, spiders, several species of ants and of beetles. *Amphibia*, tree-frogs and large toad. *Reptilia*, a small snake with reddish belly.

(17) Along the West Shore of Navy Island: *Cœlenterata*, Rhodactis Sancti Thomæ, Ricordea florida, with orange-tipped tentacles, Discosoma anemone, Isaurus sp. *Echinodermata*, Clypeaster sp. not common. *Vermes*, eggs in pear-shaped, pedunculated masses, a long, slender polychaetous annelid in mud. *Crustacea*, Stenopus hispidus, libinia-like crab, Alpheus?

(18) At Williamsfield (beyond the limits of the map) were found Aiptasia annulata?, numerous worm castings, a large black tectibranch, oysters and mussels on mangrove roots, and a blue-clawed crab like Callinectes.

(19) In the fresh brook back of the Boston Fruit Company's Wharf were found small and large shrimps, a grapsus-like crab and small fish. Near by were taken hermit crabs, Phrynus, one pseudoscorpion and six bunches of slug's eggs.

II.

The recorded distribution of the various forms mentioned is given below with numbers to indicate the above localities.

Protozoa: compound Radiolarian 12.

Porifera: purple, green and red sponges 1, 9; brown sponge 1, 5, 6; black sponge 1; white sponge 1, 7; yellow sponge 1, 7, 11. Cœlenterata: a tubularian hydroid 5, 6; Condylactis passiflora 9, 7; Aiptasia annulata 1, 5, 6, 7, 8, 9, 18; Discosoma anemone 1, 7, 8, 9, 10, 17; Siphonophores 12; Aurelia? 2, 3; Charybdea Xaymacana 2, 12; Anthomedusæ 12, 2; Physalia 7; Alcyonaria 7, 10; brownish-yellow, horny hydroid 9; Cassiopea 10; Planulæ 12, and Ephyræ 12; Lebrunea neglecta and Phymanthus crucifer 1, 10; Aiptasia lucida 1, A. lagites 8; Gemmaria sp. 1; Millepora alcicornis 1, 7, 10; Stylaster? 1, 7, 10; Rhodactis Sancti Thomæ 10, 17; Ricordea florida 7, 10, 17; Isaurus 1, 17; Phellia 1, 8 and almost all shores; Aulactinia styloides 7, 8; Actinoides pallida 7, 8 and almost all shores; Palythoa 7, 10; Zoanthus 7, 10; Meandrina, Porites, Astræa, Rhipidigorgia, 7; Asteractis sp. n.? 8 and common along shores; Actinophorus elegans, only one specimen seen 8; Bunodes granulatus 8; Discosoma helianthus 8, 9; Lebrunea coralligius 1, 10; Bunodeopsis sp. n. 9.

Echinodermata: Synapta lappa? 1, 5, 6, 7, 9, 10, 11; S. sp.? 1; Mülleria? 1, 5, 9; Stichopus 1; Toxopneustes varieagatus 5, 6; Cidaris tribuloides? 1, 5, 6, 7, 9, 10, 11; Echinometra subangularis 1, 6, 7, 8, 10, 11; Diadema setosum 1, 6, 7, 10, 11, 13; Hipponoë esculenta 1, 6, 7, 8, 9, 10, 11; Holothuria, two large forms 9, small purplish and yellowish brown 1, 7, white and yellow 7, greyish with some reddish 7, 17; Asteroids, small with roundish disk 1, 7, 17, a reddish form 1, 17, flat, small, dark green 5, arched, medium-sized green and brownish 1; Ophiurids, large with coarse spines, brick red 1, 6, 7, 10, Ophiocoma aethiops 1, 6, 7, 8, 9, 10, 13, small, black and white arms 1, 7, 13, medium-sized, no spines 1, 7, 13, medium-sized, spines, snaky arms 1, 7, 9, 13; Echinoneus 1, 6, 7, 13; Chiridota 1, 8, 7, 13; Brissus 9; small greyish-brown, third Spatangoid 1, 7, 13; Clypeastroid 13; Clypeaster 1, 17; Mellita sexforis? 5; Pentaceros reticulatus 5; Linckia, 1, 13.

Vermes: Planarian 12; Turbellarian 1, 6; flat worm parasitic in Holothuria 9; Tornaria and large bat-shaped tornaria 12; Nemerteans, slaty-blue, six inches long 6, nearly white, three inches long 1, numerous castings 11, 18; Sipunculoids 8, 11; Sagitta flaccida, S. tenuis; S. hispida 12; Oligochætæ 14, 16; Polychætæ 1, 3, 5, 6, 7, 8, 10, 11, 12, 17, 18.

Clymenella-like egg capsules 1, 17; two forms of Trochophores 12.

Mollusca: Pinna 9, 10; three species of large conchs 9, one of these also at 5, 11; Octopus, a large, light-coloured form 7, 10, a small dark form 1, 8; Boat-shell 5, 9; lamellibranch with long siphons 4, 5; Gasteropods 3, 15, 16; Land snails 11, 14, 15, 16; Slugs 11, 14, 15, 16, 19; Aplysia, a large yellow and black form 9, a small greenish and black form 1, 6, 7, 11; Chiton 1, 4, 7, 10, 11, a smaller "woolly" form 10; Fissurella 1, 7, 10; Small prosobranchs 1, 11; Nerita? 1; Oliva?, Venus-like form 11, 17; Oysters 18; Mussels 18; Large black tectibranch 18; three nudibranch forms, two at 1, and two at 7; Heteropod, Pteropod, shelled gasteropod veliger and peculiar gasteropod-like form with retractile anterior region 12.

Crustacea: fresh water shrimp and crabs 15, 19; rock-boring barnacles 10; Alpheus? 10, 17; long-legged crab 10; libinia-like crab 1, 7, 17; Callinectes; 18; Grapsus 1, 7; Gonodactylus 1, 7; Red decapod with chelæ on 3d periopods 1, 7; Phyllosome larva of Palinurus 12; Copepods 12; hermit crabs 11, 16, 19; Hippa, white form 7, brown species 4; Gelasimus 4; Lucifer 12; Stenopus hispidus 1, 11, 17; small shrimp 12; Erichthus larva 12; decapod with yellow abdomen and white cephalothorax 1; Panularis Americanus 1, 10; Zœas and megalops 12; Ostracods 12; "woolly" larva 12; Calappa marmorata 5.

Tracheata: Peripatus 11; Phrynus 16, 19; Pseudoscorpions 15, 16; Scorpions 11, 14, 16; Centipedes 3, Beetles 15, 16.

Tunicata: Appendicularia 2; Botryllus? 9; yellowish, compound ascidian 6; reddish compound ascidian 1.

Pisces: small, brightly colored fish 10; fish eggs 12; "Tobacco fish" 11; Muraena 8; small pipe fish 12; ribbon-like fish 12.

Amphibia: tree frogs 11, 15, 16; large toad 16.

Reptilia: lizard eggs 3, 15; lizards 14; a small snake 16.

III.

From some notes on dredging and surface collecting we select the following as indicative of what is to be expected from such methods of collecting at Port Antonio.

July 28th, 4.15 a. m. to sunrise, about 5.30, collecting with tow net at the mouth of the Harbor and off Navy Island yielded: Copepods (more numerous than in night towing); zœa, blue shrimps, phyllosome larva, a few large Lucifer with no eggs, numerous transparent Isopods?, Trichodesmium, very abundant, a young anemone, one sort of Siphonophore, two Ephyræ, two or three kinds of Hydromedusæ, compound Radiolarians, Campanularian on piece of weed, two or three Salpa, one or two Planarians; Sagitta flaccida, very abundant, one or two S. hispida, two or three Heteropods, two or three very large Tornariae, several Trochophores, fifteen Charybdeas, fish eggs not very common.

Two days later with the same off-shore wind and less high rollers, the collecting at the same time and place was similar to the above but less rich in forms of interest. Towing within the Harbor (4–4.30 a. m.) on this latter

lded Trichodesmium, Sagitta hispida and S. flaccida, zœas, of
na and of other crabs, fish eggs, ostracods, copepods, small shrimp,
ydromedusæ, three small Charybdeas, Mysis, two small Erichthus,
larvæ.

ıg at the bottom with fine net August 11th, in East Harbor yielded:
mphipods, black Isopods, small Copepods in great numbers and
ırge ones, several Sagitta tenuis, Trochophores, few Mysis, several
nthomedusæ, Annelid larvæ, Veligers, several Sagitta hispida, larva
zoa?

ging in East Harbor in four or five fathoms yielded: several species
s and shrimp, amphipods, sponge with Alpheus-like crustacea,
ian, Charybdea, living Astræidæ, ophiurid, Toxopneustes, Spa-
Synapta, Gasteropods, Strombus, nudibranch eggs, Tellina, Venus?,
Tapes?, Arca, Cardium, Alcyonidium, Perophora, small red Chæto-
ounder.

ging in Bryan's Bay yielded: sponges, Pennaria, Ophiurids, Hipponoë,
?, Mülleria, Stycopus, Cidaris, Diadema setosum, Toxopneustes,
kinds of Chætopods, Cerithium, Tapes?, Bulla, Venus, Strombus,
ı, Arca, Tectibranch, Pecten, Pinna, small Gasteropods, small
, Cladocera, Dromidia and other crabs, Ascidians, pipe-fish.

DEGREE OF DOCTOR OF PHILOSOPHY.

derable interest having been manifested with respect to the age at
oung men take their degrees, the following statistics have been com-
ith reference to the degree of Doctor of Philosophy. The figures
8, published last Spring, are here reproduced for purposes of com-
.

1899.

degree of Doctor of Philosophy was conferred in 1899 upon forty-
didates.

ıty-two had resided here but three years, the minimum period of
sity residence required by the rules. Of these, seventeen had been
college four years or more, many of them having devoted at least
ır to graduate work elsewhere; of the remaining five, four were
Hopkins Bachelors of three years' standing, and one had had excep-
pportunities for advanced study during his college course.

had resided here three years and a half; nine, four years; three,
ırs and a half; two, five years. One had spent only two years and
ıere; three had been here only two years; one, only one year. All
ast five had pursued graduate work elsewhere, and all but one had
ıt of college four years or more. Of the whole number graduated,
d been out of college fifteen years or more, and two others at least
rs.

average period of residence is 3.3 years. The average period since
ion from college is 7.4 years.

1898.

legree was conferred in 1898 upon thirty-six candidates.

teen had resided here but three years, and all of these had been out
ge four years or more, many of them having devoted at least one
graduate work elsewhere.

had resided here three years and a half; six, four years; three, five
one, five years and a half; two, six years; one, seven years (inter-
y). Three had spent only two years here; but all of these had
ne year or more to graduate study elsewhere, and only one had been
ollege less than four years.

average period of residence for 1898 is 3.4. The average period
st graduation is 6.5 years.

y 1, 1900.

ohn H. Latané's lectures on The Diplomatic Relations between the
States and Spanish America will be issued early in April by The
Hopkins Press. They will constitute the first volume of the Albert
ectures on Diplomatic History that have been sustained by Dr.
Shaw, of New York.

THE TWENTY-FOURTH COMMEMORATION DAY.

The annual commemoration day of the University was observed on Thursday, February 22, 1900.

The public exercises were held in McCoy Hall at eleven o'clock. The trustees and faculty, accompanied by their guests and escorted by the students, entered the hall in procession.

The prayer was offered by Rev. E. B. Niver, of Baltimore.

The Harvard Club of Maryland, by Professor W. S. Thayer, M. D., presented to the President of the University a replica of the official chair of the President of Harvard University. The chair was accepted on behalf of this University by President Gilman.

Professor Gildersleeve, on behalf of the Faculty of the University, read an address to President Gilman, congratulatory upon the twenty-fifth anniversary of his entrance upon the office of President of the University.

An address was then delivered by President Benjamin Ide Wheeler, of the University of California, on The Duties of the University toward the Commonwealth.

The degree of Doctor of Philosophy was conferred upon Rev. Adolph Guttmacher (A. B., University of Cincinnati, 1887) of Baltimore, and John Charles Olsen (A. B., Knox College, 1890 and A. M., 1893) of Illinois.

The degree of Bachelor of Arts was conferred upon the following candidates: Henry Bogue, of Baltimore, Lyttleton Morgan Chambers, of Baltimore, Albert Keidel, of Catonsville, Maurice Lazenby, of Baltimore, James Girvin Peters, of Baltimore.

Music was rendered, during the exercises, by an orchestra of twenty musicians, under the direction of Mr. Edwin L. Turnbull, of the class of '93, and by the University Glee Club, with Mr. J. Girvin Peters as leader.

The Alumni Association held its annual business meeting in McCoy Hall in the morning, and elected the following officers to serve for the ensuing year: President, Geo. Dobbin Penniman, A. B., '84; Secretary, Alfred Jenkins Shriver, A. B., '91; Treasurer, Henry Oliver Thompson, A. B., '87; Members of the Executive Committee, William J. A. Bliss, Ph. D., '94; William Henry Perkins, Jr., A. B., '84; Waldo Newcomer, A. B., '89; Redmond Conyngham Stewart, A. B., '92; Douglas Hamilton Thomas, Jr., A. B., '93; John H. King, A. B., '99.

The Annual Alumni dinner was held at the Hotel Rennert in the evening. Addresses were made by President Gilman, President Wheeler, Hon. Thomas G. Hayes, Mayor of Baltimore, Mr. C. Morton Stewart and others.

The Twenty-fourth Annual Report of the President of the Johns Hopkins University has just been issued. It contains 116 pages, octavo, and includes, in addition to the President's Report, Reports on the Instruction in the Chief Branches of Study, and other supplemental matter.

Of the Memoirs from the Biological Laboratory, Volume IV is now completed. The contents of the volume are as follows:

The Cubomedusae. By Franklin Story Conant, with eight folio plates.
Synapta Vivipara. By H. L. Clark, with five folio plates.
Yoldia Limatula. By Gilman A. Drew, with five folio plates.
Physiology and Histology of the Cubomedusae, including Dr. F. S. Conant's Notes on the Physiology. By E. W. Berger, with three folio plates.
Ophiura Brevispina. By Caswell Grave, with three folio plates.

No. 4 of Volume XX, of the American Journal of Philology (to appear this month), will contain an index to Vols. XI to XX of that Journal. There has also just been issued a detailed index to Vol. XI to XX of the American Chemical Journal, prepared by Dr. J. Elliott Gilpin.

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JOHNS HOPKINS UNIVERSITY STUDIES IN HISTORICAL AND POLITICAL SCIENCE.

HERBERT B. ADAMS, EDITOR.

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Clark, F. E.
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Flinn, F. B.
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Humphreys, R. E.
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Taveau, R. de M.
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Simmons, W. W.
Taveau, R. de M.
Yamaguchi, K.

Physical Chemistry: Dr. H. C. Jones. Monday, Tuesday, Wednesday, 12 m. (10).

Caldwell, B. P.
Chambers, V. J.
Clark, F. E.
Frazer, J. C.
Hall, E. S.
King, S. H.
Lindsay, C. F.
Olsen, J. C.
Smith, A. W.
Yamaguchi, K.

Inorganic Chemistry: (*Major Course*): Professor Morse. Daily, except Monday, 9 a. m. (28).

Abercrombie, R. T.
Brooks, C. E.
Brown, J. R. C.
Bye, M.
Constantine, C. W.
Dapprich, F. R.
Hall, E. S.
Hatch, E. C.
James, W. McC.
Leopold, E. J.
Love, J. M.
Mackall, L. L.
Mower, F. D.
Neal, W. D.
Porter, G. F.
Rehberger, G. E.
Rehberger, J. M.
Riggins, J. A.
Schaun, P. E.
Shipley, S. D.
Shippen, L. P.
Shreve, O. F.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Washington, F. J.
West, A. P.
Whitehill, I. E.

General Chemistry: (*Minor Course*): Professor Renouf and Dr. Gilpin. Daily, except Monday, 9 a. m., Hopkins Hall. (51).

Barrett, J. T.
Beasley, E. B.
Beeuwkes, H.
Bernheim, B. M.
Bernheim, E. P.
Bird, A. R.
Boyer, N.
Brown, E. B.
Buttner, W. J.
Byrne, H. S.
Campbell, J. G.
Clark, C. T.
Crane, R. T.
Fishach, L. G.
Gillespie, H. C.
Hazen, H. H.
Hill, E. C.
Hoffman, W. E.
Hoge, J. F. D.
Hollander, L. M.
Hutzler, L. S.
Keller, J. F.
Kenney, W. C.
King, J. H.
Koppelman, W. H.
Lindheim, N. R.
Macht, D. I.
McGlone, B.
Moore, R. E.
Murphy, L. C.
Pels, I. R.
Pinkerton, T. C.
Powers, H. W. S.
Putts, B. S.
Remsen, C. M.
Reynolds, W. F.
Sayler, J. A.
Schermerhorn, A. V. R.
Sisco, G. E.
Slemons, J. A.
Snavely, G. E.
Stone, H. B.
Strouse, S.
Turnbull, B.
Tyler, J. E.
Vickers, H. W.
Watkins, R. H.
Whitehead, R. F.
Whitman, H. S.
Wolman, S.
Wroth, P.

Laboratory Work: Professor Remsen, Professor Morse, Professor Renouf, Dr. Gilpin, Dr. H. C. Jones, and Assistants. Daily, 9 a. m. to 5 p. m. (114).

Abercrombie, R. T.
Barrett, J. T.
Beasley, E. B.
Beck, G. C.
Beeuwkes, H.
Bernheim, B. M.
Bernheim, E. P.
Bird, A. R.
Bird, R. M.
Black, H. V.
Blanchard, W. M.
Boyer, N.
Brooks, C. E.
Brown, E. B.
Brown, J. R. C.
Buttner, W. J.
Bye, M.
Byrne, H. S.
Caldwell, B. P.
Campbell, J. G.
Canter, H.
Carter, J. D.
Case, W. A.
Caspari, C. E.
Chambers, V. J.
Chambliss, H.
Clark, C. T.
Clark, F. E.
Constantine, C. W.
Crane, R. T.
Dapprich, F. R.
Douglas, J. M.
Eager, J. H.
Edmunds, C. K.
Fishach, L. G.
Flinn, F. B.
Frazer, J. C. W.
Garner, W. W.
Gillespie, H. C.
Hall, E. S.
Hancock, F. A.
Harris, C. D.
Hatch, E. C.
Hazen, H. H.
Hill, E. C.
Hoffman, W. E.
Hoge, J. F. D.
Hollander, L. M.
Horn, D. W.
Humphreys, R. E.
Hutzler, L. S.
James, W. McC.
Keller, J. F.
Kenney, W. C.
King, J. H.
King, S. H.
Kirby, F. J.
Koppelman, W. H.
Leopold, E. J.
Lindheim, N. R.
Lindsay, C. F.
Love, J. M.
Macht, D. I.
Mackall, L. L.
McGlone, B.
Moore, R. E.
Mower, F. D.
Murphy, L. C.
Neal, W. D.
Olsen, J. C.
Patterson, A. M.
Pels, I. R.
Pinkerton, T. C.
Porter, G. F.
Powers, H. W. S.
Putts, B. S.
Rehberger, G. E.
Rehberger, J. M.
Remsen, C. M.
Reynolds, W. F.
Riggins, J. A.
Robertson, C. B.
Russell, G. W.
Sayler, J. A.
Schaun, P. E.
Schermerhorn, A. V. R.
Schultz, C. H.
Shipley, S. D.
Shippen, L. P.
Shreve, O. F.
Simmons, W. W.
Sisco, G. E.
Slemons, J. A.
Smith, A. W.
Snavely, G. E.
Spencer, L. C.
Stone, H. B.
Straus, H. P.
Strouse, S.
Struth, O. A.
Swindell, W. B.
Taveau, R. de M.
Turnbull, B.
Tyler, J. E.
Vickers, H. W.
Washington, F. J.
Watkins, R. H.
West, A. P.
Whitehead, R. F.
Whitehill, I. E.
Whitman, H. S.
Wolman, S.
Wroth, P.
Yamaguchi, K.

Geology. (26 Students).

Classes meet in the Geological Laboratory.

Historical Geology: Professor Clark. Tuesday and Wednesday, 9 a. m. (8).

Bonsteel, J. A.
Hindshaw, H. H.
Martin, G. C.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Wright, F. B.

Paleontology: (*Laboratory Work*): Professor Clark and Dr. Shattuck. Daily. (8).

Bonsteel, J. A.
Duerden, J. E.
Martin, G. C.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Wright, F. B.

General Geology: (*Minor Geology*): Dr. Shattuck. Daily, except Friday, 1 p. m. (19).

Baldauf, L. K.
Beck, G. C.
Bird, A. R.
Bonsteel, J. A.
Hall, E. S.
Harris, C. D.
Kerr, R. C.
Mackall, L. L.
Martin, G. C.
Neal, W. D.
Porter, G. F.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Shipley, S. D.
Simmons, W. W.
West, A. P.
Wolf, M. W.
Wright, F. B.

Exploratory Surveying: Associate Professor Reid. Monday and Thursday, 9 a. m. (5).

Bonsteel, J. A.
Neal, W. D.
Martin, G. C.
Richardson, G. B.
Romine, A. P.

Advanced Mineralogy: Associate Professor Mathews. Monday, Wednesday, and Friday, 11 a. m. (7).

Bonsteel, J. A.
Martin, G. C.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Wright, F. B.

General Mineralogy: (*Major Geology*): Associate Professor Mathews. Daily, except Thursday, 12 m. (8).

Bonsteel, J. A.
Carter, J. D.
Flinn, F. B.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Taveau, R. de M.
Wright, A.

Physiographic Geology: Dr. Shattuck. Tuesday, 10 a. m. (7).

Bonsteel, J. A.
Martin, G. C.
Neal, W. D.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Wright, F. B.

Journal Meeting: Professor Clark. Tuesday, 11 a. m. (13).

Bibbins, A.
Bonsteel, J. A.
Fassig, O. L.
Hindshaw, H. H.
Martin, G. C.
Mathews, E. B.
Neal, W. D.
Reid, H. F.
Richardson, G. B.
Romine, A. P.
Rowe, R. B.
Shattuck, G. B.
Wright, F. B.

Biology. (92 Students).

Advanced Zoology: Professor Brooks. Daily, Biological Laboratory. (7).

Curtis, W. C.
Duerden, J. E.
Eyster, J. A. E.
Griffin, L. E.
Perkins, H. F.
Reese, A. M.
Shoemaker, D. N.

Zoological and Botanical Journal Club: Professor Brooks, Associate Professor Andrews, Dr. D. S. Johnson. Friday, 11 a. m., Biological Laboratory. (13).

Barton, B. W.
Coker, W. C.
Curtis, W. C.
Drew, G. A.
Duerden, J. E.
Eyster, J. A. E.
Griffin, L. E.
Metcalf, M. M.
Perkins, H. F.
Reese, A. M.
Shoemaker, D. N.
Stiles, P. G.
Woodruff, E. S.

Zoology and Comparative Anatomy: (*Major Biology*): Professor Brooks and Dr. D. S. Johnson. Daily, except Monday, 9 a. m., Monday and Tuesday, 2–5 p. m., until April 1, Biological Laboratory. (6).

Breed, A. A.
Glaser, O. C.
Perkins, H. F.
Rous, F. P.
Shoemaker, D. N.
Woodruff, E. S.

Embryology: (*Major Biology*): Associate Professor Andrews. Daily, except Monday, 9 a. m., Monday and Tuesday, 2–5 p. m., after April 1, Biological Laboratory. (6).

Breed, A. A.
Glaser, O. C.
Perkins, H. F.
Rous, F. P.
Shoemaker, D. N.
Woodruff, E. S.

Physiological Journal Club: Professor Howell. Monday, 10 a. m., Physiological Laboratory. (7).

Dawson, P. M.
Dreyer, G. P.
Herrick, J. C.
Hunt, R.
Pratt, F. H.
Stiles, P. G.
Walden, E. C.

Physiological Seminary: Professor Howell. Monday, 11 a. m., Physiological Laboratory. (7).

Dawson, P. M.
Dreyer, G. P.
Herrick, J. C.
Hunt, R.
Pratt, F. H.
Stiles, P. G.
Walden, E. C.

Animal Physiology: Professor Howell and Dr. Dreyer. Wednesday, Thursday, and Friday, 2–5 p. m., from January to June, Physiological Laboratory. (3).

Duerden, J. E.
Perkins, H. F.
Shoemaker, D. N.

Physiology of the Tissues, Circulation, Digestion, and Nutrition: (*For Medical Students*): Professor Howell. Daily, 11.30 a. m., Physiological Laboratory. (50).

Barker, M. L.
Bassett, V. H.
Bennett, R.
Bixler, L. C.
Blauvelt, E. H.
Brush, C. E.
Chatard, J. A.
Chinn, G. E.
Clark, A. H.
Cornell, W. B.
Dewey, E. G.
Edwards, R. T.
Fayerweather, R.
Fischer, J. S.
Gaenslen, F. J.
Gaines, L. M.
Geraghty, J. T.
Goldsborough, F. C.
Haskell, L. W.
Hirschfelder, A. D.
Hopkins, R.
Hunter, P. S.
Hutchins, H. T.
Jones, C. L.
Keidel, A.
Kingsbury, H. P. D.
Lazenby, M.
Loevenhart, A. S.
Long, H. D.
Lupton, E. J. S.
Lynch, L. A.
Manning, W. S.
Marshall, W.
McClintock, R. W.
Miller, R. T.
Morse, M. E.
Moulton, W. B.
Neagle, H. B.
Rainforth, S. I.
Riley, B. F.
Robinson, G. C.
Schmitter, F.
Schultz, O. T.
Smith, W. H.
Stevens, A. R.
Tayler, L.
Thompson, W. L.
Travis, C. H.
Watson, F. H.
Young, C. W.

Biology : (*Minor Course*): Associate Professor ANDREWS. ccept Tuesday, 10 a. m., Thursday and Friday, 2–5 p. m., l Laboratory. (28).

K.
. J.
, C.W.
M.
. E.
Hand, J. P.
Heald, H. B.
Homer, H. L.
King, J. H.
Kirby, F. J.
Love, J. M.
Marshall, T. H.
Mason, S. T.
Moore, J. S.
Ogle, M. B.
Rehberger, G. E.
Remsen, C. M.
Shreve, O. F.
Struth, O. A.
Taneyhill, G. L.
Washington, F. J.
Whitehill, I. E.
Wingert, M.
Winslow, N.
Woodruff, E. S.
Wright, A.

ogy of Plants : Dr. D. S. JOHNSON. Thursday and Friday, boratory work, Thursday and Friday, 10 a. m. to 1 p. m., 2–5 p. m., Biological Laboratory. (3).

Eyster, J. A. E.
Shoemaker, D. N.

(*Elective Course*): Dr. D. S. JOHNSON. Tuesday and Wednes- m., Biological Laboratory. (2).

McAll, R. L.

ry Work : Professor BROOKS, Professor HOWELL, Asso- fessor ANDREWS, Dr. DREYER, Dr. D. S. JOHNSON, Dr. DREW, SON. Daily, 9 a. m. to 5 p. m., Biological and Physiological ries. (90).

K.
I.
. J.
H.
A.
C.W.
B.
M.
E.
T.
E.
r, R.
Fischer, J. S.
Gaenslen, F. J.
Gaines, L. M.
Geraghty, J. T.
Glaser, O. C.
Goldsborough, F. C.
Griffin, L. E.
Hand, J. P.
Haskell, L. W.
Heald, H. B.
Herrick, J. C.
Hirschfelder, A.D.
Homer, H. L.
Hopkins, R.
Hunter, P. S
Hutchins, H. T.
Jones, C. L.
Keidel, A.
King, J. H.
Kingsbury, H. P. D.
Kirby, F. J.
Lazenby, M.
Loevenhart, A. S.
Long, H. D.
Love, J. M.
Lupton, E. J. S.
Lynch, L. A.
Manning, W. S.
Marshall, T. H.
Marshall, W.
Mason, S. T.
McAll, R. L.
McClintock, R.W.
Miller, R. T.
Moore, J. S.
Morse, M. E.
Moulton, W. B.
Neagle, H. B.
Ogle, M. B.
Perkins, H. F.
Rainforth, S. I.
Reese, A. M.
Rehberger, G. E.
Remsen, C. M.
Riley, B. F.
Robinson, G. C.
Rous, F. P.
Schmitter, F.
Schultz, O. T.
Shoemaker, D. N.
Shreve, O. F.
Smith, W. H.
Stevens, A. R.
Struth, O. A.
Taneyhill, G. L.
Tayler, L.
Thompson, W. L.
Travis, C. H.
Walden, E. C.
Washington, F. J.
Watson, F. H.
Whitehill, I. E.
Wingert, M.
Winslow, N.
Woodruff, E. S.
Wright, A.
Young, C. W.

31 Students).

Classes meet in McCoy Hall.

minary : *Thukydides:* Professor GILDERSLEEVE. Monday nesday, 10 a. m., Room 14. (14).

. T.
H.
H.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
McGuire, C. B.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

f the Cases : Professor GILDERSLEEVE. Tuesday, 10 a. m., (16).

. T.
H.
H.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Kern, J. W.
McGuire, C. B.
Milden, A. W.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

istoriography : Professor GILDERSLEEVE. Thursday, 10 om 14. (16).

. T.
H.
H.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Kern, J. W.
McGuire, C. B.
Milden, A. W.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

utics and Criticism : Professor GILDERSLEEVE. Friday, Room 14. (14).

. T.
H.
H.
Foushee, W. L.
Guernsey, R.
McGuire, C. B.
Milden, A. W.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

alaeography : Associate Professor MILLER. Tuesday sday, 9 a. m., Room 15. (11).

. T.
L.
Guernsey, R.
Kern, J. W.
McGuire, C. B.
Milden, A. W.
Pyle, T. L.
Ragland, G.
Raney, L.
Spilman, E. A.

says and Conversation : Associate Professor MILLER. y and Friday, 9 a. m., Room 15. (7).

. T.
Foushee, W. L.
Guernsey, R.
Ragland, G.
Raney, L.
Spilman, E. A.

ets ; Sophokles, *Ajax:* (*Major Course*): Associate Professor Monday, Tuesday, and Wednesday, 12 m., Room 10. (8).

Fishach, L. G.
Machen, J. G.
Manken, H.
Noble, E. R.
Powers, H. W. S.
Spencer, L. C.

24 ; ***Euripides,*** *Alkestis:* (*Minor Course*): Associate Pro- EKER. Tuesday, Wednesday, and Thursday, 1 p. m., Room

Heald, H. B.
Mason, S. T.
Nininger, M. L.
Ogle, M. B.
Reider, C.

Herodotus ; Prose Composition : Associate Professor MILLER. Monday, 10 a. m., Room 8; Thursday and Friday, 11 a. m., Room 7. (1).

Hildt, J. C.

Prose Composition : Associate Professor SPIEKER.

Major Course: Friday, 12 m., Room 10. (8).

Booker, J. M.
Briscoe, J. S.
Fishach, L. G.
Machen, J. G.
Manken, H.
Noble, E. R.
Powers, H. W. S.
Spencer, L. C.

Minor Course: Monday, 1 p. m., Room 10. (7).

Dew, A. G.
Hand, J. P.
Heald, H. B.
Mason, S. T.
Nininger, M. L.
Ogle, M. B.
Reider, C.

Latin. (61 Students).

Classes meet in McCoy Hall.

Latin Seminary : *Juvenal:* Associate Professor SMITH. Tuesday and Friday, 11 a. m., Room 15. (16).

Archibald, H. T.
Austin, F. M.
Blackwell, I. H.
Canter, H. V.
Edwards, P. H.
Foote, T. C.
Griffith, G.
Guernsey, R.
Hullihen, W.
McGuire, C. B.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

Roman Satire : Associate Professor SMITH. Monday, 11 a. m., Room 15. (19).

Archibald, H. T.
Austin, F. M.
Blackwell, I. H.
Canter, H. V.
Edwards, P. H.
Foote, T. C.
Foster, H. B.
Foushee, W. L.
Griffith, G.
Guernsey, R.
Hullihen, W.
McGuire, C. B.
Milden, A. W.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

Seneca's *Apocolocyntosis;* ***Apuleius :*** Associate Professor SMITH. Wednesday, 11 a. m., Room 15. (17).

Archibald, H. T.
Austin, F. M.
Blackwell, I. H.
Canter, H. V.
Edwards, P. H.
Foote, T. C.
Griffith, G.
Guernsey, R.
Hullihen, W.
McGuire, C. B.
Milden, A. W.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

Journal Club : Associate Professor SMITH. Wednesday, 12 m., Room 15. (16).

Archibald, H. T.
Austin, F. M.
Blackwell, I. H.
Canter, H. V.
Edwards, P. H.
Guernsey, R.
Hullihen, W.
McGuire, C. B.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

Historical Latin Grammar : Dr. WILSON. Thursday, 11 a. m., Room 15. (16).

Archibald, H. T.
Austin, F. M.
Blackwell, I. H.
Canter, H. V.
Edwards, P. H.
Foote, T. C.
Griffith, G.
Guernsey, R.
Hullihen, W.
McGuire, C. B.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.

Lucretius : (*Undergraduate Elective*): Associate Professor SMITH. Tuesday and Wednesday, 3 p. m., Room 15. (8).

Anderson, R. B. T.
Burrell, J. L. A.
Eager, J. H.
Ewell, J. E.
Hollander, L. M.
Mulford, R. J.
Purcell, T. N. D.
Roulston, R. B.

Plautus ; Terence : (*Major Course*): Dr. WILSON. Wednesday, Thursday, and Friday, 10 a. m., Room 10. (8).

Austin, F. M.
Briscoe, J. S.
Fishach, L. G.
Machen, J. G.
Noble, E. R.
Powers, H. W. S.
Snavely, G. E.
Spencer, L. C.

Roman Literature : (*Minor Course*): Associate Professor SMITH. Tuesday, 9 a. m., Room 11. (13).

Baker, H. R.
Bandel, B. B.
Diggs, R. M.
Guggenheimer, F. L.
Kirk, W.
Marbury, O.
Markell, C.
Pearre, A.
Ranft, C. F.
Schmeisser, W. C.
Sharretts, R. C.
Smith, S.
Strouse, E.

Horace : (*Minor Course*): Dr. SUTPHEN. Wednesday, Thursday, and Friday, 9 a. m., Room 12. (24).

Baker, H. R.
Bandel, B. B.
Dew, A. G.
Diggs, R. M.
England, J. T.
Guggenheimer, F. L.
Hand, J. P.
Heald, H. B.
Hildebrandt, L. F.
Kirk, W.
Marbury, O.
Markell, C.
Mason, S. T.
Miller, H. C.
Mower, McH.
Myers, C. A.
Ogle, M. B.
Pearre, A.
Ranft, C. F.
Reider, C.
Schmeisser, W. C.
Sharretts, R. C.
Smith, S.
Strouse, E.

Ovid ; Vergil ; Prose Composition : Dr. SUTPHEN. Wednesday, Thursday, and Friday, 10 a. m., Room 8. (3).

Hildt, J. C.
Hoffman, R. C.
White, L. J.

Prose Composition :

Major Course: Dr. WILSON. Monday, 10 a. m., Room 10. (7).

Briscoe, J. S.
Fishach, L. G.
Machen, J. G
Noble, E. R.
Powers, H. W. S.
Snavely, G. E.
Spencer, L. C.

Minor Course: Dr. SUTPHEN. Tuesday, 9 a. m., Room 12. (11).

Dew, A. G.
England, J. T.
Hand, J. P.
Heald, H. B.
Hildebrandt, L. F.
Mason, S. T.
Miller, H. C.
Mower, McH.
Myers, C. A.
Ogle, M. B.
Reider, C.

Sanskrit and Comparative Philology. (38 Students).

Classes meet in McCoy Hall, Room 19.

Comparative Philology: Professor BLOOMFIELD. Monday, 4 p. m. (22).

Anderson, R. B. T.
Austin, F. M.
Burrell, J. L. A.
Drenford, G.
Drewry, W. S.
Eager, J. H.
Ewell, J. E.
Griffin, J. W.
Groome, P. L.
Hill, H. D.
Kern, J. W.
Martin, W. E.
Myers, W. S.
Nininger, M. L.
Purcell, T. N. D.
Raney, L.
Roulston, R. B.
Schneider, J. P.
Stephens, J. C.
Turnbull, B.
Visvanath, S. J.
Weaver, C. C.

Comparative Grammar of Indo-European Consonants: Professor BLOOMFIELD. Friday, 4 p. m. (17).

Archibald, H. T.
Austin, F. M.
Blackwell, I. H.
Drenford, G.
Ewing, A. H.
Foster, H. B.
Foushee, W. L.
Guernsey, R.
Lyon, C. E.
Milden, A. W.
Nininger, M. L.
Pyle, T. L.
Ragland, G.
Raney, L.
Smith, C. S.
Spilman, E. A.
Visvanath, S. J.

Vedic Seminary: *The Rig-Veda:* Professor BLOOMFIELD. Thursday, 12 m. (6).

Blake, F. R.
Drenford, G.
Ewing, A. H.
Foster, H. B.
Kurrelmeyer, H.
Ness, J. A.

The Bṛhad-Āraṇyaka-Upaniṣad: Professor BLOOMFIELD. Tuesday, 12 m. (5).

Blake, F. R.
Drenford, G.
Ewing, A. H.
Foster, H. B.
Ness, J. A.

Introduction to the Study of the Vedas: Professor BLOOMFIELD. Monday, 12 m. (9).

Archibald, H. T.
Blackwell, I. H.
Drenford, G.
Ewing, A. H.
Guernsey, R.
Kurrelmeyer, H.
Pyle, T. L.
Ragland, G.
Smith, C. S.

Elementary Sanskrit: *Whitney's Grammar; Lanman's Reader:* Professor BLOOMFIELD. Tuesday and Thursday, 4 p. m. (6).

Drenford, G.
Edwards, P. H.
Nininger, M. L.
Raney, L.
Spilman, E. A.
Visvanath, S. J.

Oriental Seminary. (25 Students).

Classes meet in the Dillmann Library, McCoy Hall, Room 18.

The Literature of the Old Testament: Professor HAUPT. Friday, 5 p. m. (12).

Arnold, B. W.
Bird, R. M.
Blake, F. R.
Ember, A.
Foote, T. C.
Grimm, K. J.
Groome, P. L.
Hollander, L. M.
Martin, W. E.
Richardson, G. B.
Shoemaker, D. N.
Wolman, S.

Literature of Ancient Egypt: Associate Professor JOHNSTON. Friday, 11 a. m. (8).

Blake, F. R.
Dennis, J. T.
Drenford, G.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.
Routh, J. E.
Wicker, W. C.

Elementary Hebrew: Professor HAUPT and Mr. BLAKE. Monday, 2–4 p. m. (7).

Anderson, R. B. T.
Drenford, G.
Ember, A.
Litsinger, W. H.
Manken, H.
Roulston, R. B.
Wicker, W. C.

Unpointed Hebrew Texts: Dr. GRIMM. Monday, 12 m. (3).

Blake, F. R.
Drenford, G.
Foote, T. C.

Hebrew at Sight: Associate Professor JOHNSTON. Tuesday, 10 a. m. (5).

Drenford, G.
Ember, A.
Foote, T. C.
McPherson, W. B.
Wicker, W. C.

Hebrew Prose Composition: Professor HAUPT. Thursday, 3 p. m. (7).

Blake, F. R.
Ember, A.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.
Rosenau, W.
Wicker, W. C.

Old Testament Seminary: *Deutero-Isaiah:* Professor HAUPT. Tuesday, 2–4 p. m. (9).

Blake, F. R.
Drenford, G.
Ember, A.
Foote, T. C.
Guttmacher, A.
Grimm, K. J.
McPherson, W. B.
Rosenau, W.
Wicker, W. C.

Syriac: Associate Professor JOHNSTON. Friday, 10 a. m. (2).

Blake, F. R.
Drenford, G.

Ethiopic: (*Second Year*): Professor HAUPT. Friday, 4 p. m. (3).

Blake, F. R.
Drenford, G.
Grimm, K. J.

Elementary Arabic: Associate Professor JOHNSTON. Tuesday, 9 a. m. (3).

Dennis, J. T.
Foote, T. C.
Wicker, W. C.

Arabic Prose Composition: Professor HAUPT. Wednesday, 3 p. m. (8).

Blake, F. R.
Dennis, J. T.
Ewing, A. H.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.
Rosenau, W.
Wicker, W. C.

Assyrian: (*Second Year*): Associate Professor JOHNSTON. Thursday, 11 a. m., and Friday, 12 m. (4).

Blake, F. R.
Drenford, G.
Foote, T. C.
McPherson, W. B.

Assyrian Prose Composition: Professor HAUPT. Thursday, 3 p. m. (4).

Blake, F. R.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.

Assyrian Seminary: (*Nimrod Epic*): Professor HAUP
day, 4 p. m. (4).

Blake, F. R.
Foote, T. C.
Grimm, K. J.
McPh

Cuneiform Syllabaries: Dr. GRIMM. Friday, 3 p. m.

Blake, F. R.
Drenford, G.
Foote, T. C.

Sumerian: Professor HAUPT. Tuesday, 4 p. m. (4).

Blake, F. R.
Foote, T. C.
Grimm, K. J.
McPh

Comparative Semitic Syntax: Professor HAUPT. Tl
p. m. (8).

Blake, F. R.
Drenford, G.
Ember, A.
Foote, T. C.
Grimm, K. J.
McPherson, W. B.
Rosen
Wick

Old Egyptian: (*Second Year*): Associate Professor JOHNST
day, 10 a. m. (5).

Blake, F. R.
Dennis, J. T.
Drenford, G.
Grimm, K. J.
McPh

Old Egyptian: (*Elementary*): Associate Professor JOHNST
day, 1 p. m. (1).

De Grange, M.

Coptic: Associate Professor JOHNSTON. Tuesday, 11 a. m.,
9 a. m. (6).

Blake, F. R.
De Grange, M.
Dennis, J. T.
Drenford, G.
Grimm, K. J.
McPh

English. (153 Students.)

Classes meet in McCoy Hall.

English Seminary: *Epic poetry, especially Milton's Paradi*
Paradise Regained; and Beowulf: Professor BRIGHT. Tu
Thursday, 3–5 p. m., Room 4. (16).

Brown, G. D.
Crenshaw, J. B.
Eckenrode, H. J.
Embry, J.
Farr, J. M.
Fosnocht, E. B.
Griffith, G.
Hagen, S. N.
Heald, E. de F.
Huguenin, J.
Kennedy, J. B.
Lotspeich, C. M.
Miles,
Miller
Schne
West,

English Grammar: *Lectures on Modern English Grammar*
BRIGHT. Thursday, 12 m., Room 12. (9).

Brown, G. D.
Embry, J.
Farr, J. M.
Griffith, G.
Hagen, S. N.
Heald, E. de F.
Huguenin, J.
Miles
Miller

Mediæval Literature: *Havelok the Dane:* Professor BRIG
day, 11 a. m., Room 4. (10).

Brown, G. D.
Embry, J.
Farr, J. M.
Griffith, G.
Hagen, S. N.
Heald, E. de F.
Huguenin, J.
Kennedy, J. B.
Miles,
Miller

Journal Meeting: Professor BRIGHT. Alternate Fridays
Room 4. (16).

Brown, G. D.
Crenshaw, J. B.
Eckenrode, H. J.
Embry, J.
Farr, J. M.
Fosnocht, E. B.
Griffith, G.
Hagen, S. N.
Heald, E. de F.
Huguenin, J.
Kennedy, J. B.
Lotspeich, C. M.
Miles,
Miller
Schne
West,

Anglo-Saxon: *Bright's Anglo-Saxon Reader:* (*Major En*
WEST. Tuesday, 11 a. m., Room 8; Thursday, 10 a. m., Roo

Eckenrode, H. J.
Ember, A.
Kennedy, J. B.
Lotspeich, C. M.
Miller, R. D.
Smull,

Literary History of the English Bible; Scotti
from Lyndsay to Burns: (*For Graduates*): Professo
Wednesday, 11 a. m., Room 8. (8).

Brown, G. D.
Eckenrode, H. J.
Farr, J. M.
Hagen, S. N.
Heald, E. de F.
Huguenin, J.
Kenn
Wick

Elizabethan Literature; Early Scottish Poets: (
lish): Professor BROWNE. Tuesday and Friday, 12 m., Roo

Ember, A.
Embry, J.
Smull, M. N.

Early English Texts; English Literature: (*Mino*
Professor BROWNE. Daily, except Friday, 1 p. m., Room 6

Abercrombie, R. T
Brooks, C. E.
Clark, C. T.
Greene, J. D.
Hildebrandt, L. F
Hollander, L. M.
Lowndes, E.
Mower, McH.
Myers
Winsl

English Literature: (*Undergraduate Elective*): Professo
Thursday, 12 m., Friday, 1 p. m., Room 9. (12).

Beeuwkes, C. J.
De Grange, M.
Glaser, O. C.
Griffin, J. W.
Hill, J. P.
Liddell, D. M.
Marshall, T. H.
Moore, J. S.
Roulston, R. B.
Smull
Steph
Turnb

English Literature: (*Required Undergraduate Course*):
GREENE. Monday, 9 a. m., Tuesday, 10 a. m., Wednesday
Room 11. (50).

Abercrombie, R. T.
Baker, H. R.
Baldauf, L. K.
Bandel, J. M.
Bird, A. R.
Booker, J. M.
Boyer, N.
Briscoe, J. S.
Brown, E. B.
Bruton, A. W.
Bye, M.
Byrne, H. S.
Constantine, C. W.
Cronin, F. H.
Dapprich, F. R.
Duck, R. S.
Fishach, L. G.
Flinn, F. B.
Griffin, E. J.
Griffith, W. A.
Harris, W. H.
Hatch, E. C.
Hollander, L. M.
James, W. McC.
Kohn, W. I.
Leopold, E. J.
Machen, J. G.
Morgan, S. C.
Morse, R. B.
Mower, F. D.
Noble, E. R.
Powers, H. W. S.
Raffel, H. B.
Rehberger, G. E.
Riggins, J. A.
Routh, J. E.
Sayler, J. A.
Shippen, L. P.
Shreve
Snavel
Spenc
Stein,
Strous
Struth
Swind
Tyler,
Warn
Washi
West,
Wolf,

French Conversation: Mr. TEILLARD. Wednesday, 4 p. m., Room 2. (4).

Shreve, O. F.
Stidman, A. G.
Struth, O. A.
Swindell, W. B.

Popular Latin: Professor ELLIOTT. Monday, 12 m., Room 2. (3).

Batchelder, J. D.
Gould, W. E.
Frost, F. L.

Old Provençal: Dr. ARMSTRONG. Thursday, 9 a. m., Room 2. (7).

Batchelder, J. D.
Critchlow, F. L.
Curdy, A. E.
Gould, W. E.
Morrison, A. J.
Mosemiller, C. A.
Shaw, J. E.

Spanish Seminary: Associate Professor MARDEN. Thursday, 11 a. m., Room 2. (3).

Batchelder, J. D.
Frost, F. L.
Gould, W. E.

Spanish Philology: Associate Professor MARDEN. Tuesday and Friday, 10 a. m., Room 2. (4).

Batchelder, J. D.
Canter, H. V.
Frost, F. L.
Gould, W. E.

Old Spanish Readings: Associate Professor MARDEN. Friday, 12 m. (5).

Canter, H. V.
Critchlow, F. L.
Curdy, A. E.
Harry, P. W.
Morrison, A. J.

Early Spanish Drama: Associate Professor MARDEN. Thursday, 12 m., Room 2. (8).

Batchelder, J. D.
Canter, H. V.
Critchlow, F. L.
Curdy, A. E.
Frost, F. L.
Gould, W. E.
Harry, P. W.
Morrison, A. J.

Romance Palæography: Dr. KEIDEL. Monday, 9 a. m., Room 2. (4).

Critchlow, F. L.
Curdy, A. E.
Harry, P. W.
Morrison, A. J.

Romance Club: Professor ELLIOTT. Wednesday, 11 a. m., Room 2. (11).

Batchelder, J. D.
Critchlow, F. L.
Curdy, A. E.
Frost, F. L.
Gould, W. E.
Harry, P. W.
Morrison, A. J.
Mosemiller, C. A.
Shaw, J. E.
Stidman, A. G.
Teillard, X.

Undergraduate Courses.

French: (*Major Course*): Dr. BRUSH. Monday, Wednesday, and Friday; Dr. OGDEN. Thursday, 10 a.m., Room 7. (6).

Crane, R. T.
Hill, J. P.
Lowndes, E.
Sayler, J. A.
Swindell, W. B.
Tyler, J. E.

French: (*Minor Course, Class A*): Dr. ARMSTRONG. Daily, except Thursday, 12 m., Room 7. (16).

Anderson, R. B. T.
Cronin, F. H.
Dapprich, F. R.
Eager, J. H.
Griffin, J. W.
Hatch, E. C.
Hoffman, R. C.
Leopold, E. J.
Lisberger, S. J.
McAll, R. L.
Morse, R. B.
Purcell, T. N. D.
Raffel, H. B.
Rehberger, G. E.
Stein, J. S.
Struth, O. A.

French: (*Minor Course, Class B*): Dr. OGDEN. Daily, except Thursday, 12 m., Room 6. (11).

Bernheim, B. M.
Burrell, J. L. A.
Constantine, C. W.
Duck, R. S.
Ewell, J. E.
Griffith, G.
Griffith, W. A.
Kennedy, J. B.
Liddell, D. M.
Mower, F. D.
Strouse, E.

French: (*Elementary Course*): Dr. BRUSH. Monday and Tuesday, 11 a. m., Room 7; Wednesday, 12 m., Room 8. (2).

Hattori, Y.
Hildt, J. C.

French: (*Elective Course*): Dr. OGDEN. Thursday and Friday, 1 p. m., Room 11. (4).

Ember, A.
Smith, W. L.
Warner, H. M.
Whitman, H. S.

Italian: (*Minor Course*): Dr. BRUSH. Monday, Room 6, Tuesday, Thursday, and Friday, Room 7, 9 a. m. (2).

Greene, J. D.
Taneyhill, G. L.

Italian: (*Elective Course*): Dr. OGDEN. Monday, 10 a. m., Thursday, 11 a. m. (3).

Ember, A.
Farr, J. M.
Huguenin, J.

Spanish: (*Minor Course*): Associate Professor MARDEN. Daily, except Monday, 9 a. m., Room 8. (8).

Bandel. J. M.
Bruce, E. S.
Ember, A.
Heyman, S.
Hill, W. B.
Kohn, W. I.
Norton, E. L.
Stephens, J. C.

Spanish: (*Elective Course*): Associate Professor MARDEN. Monday, 9 a. m., Friday, 1 p. m., Room 10. (3).

Foster, F.
Lowndes, E.
Weston, K. E.

Special Courses.

Spanish: (*Conversation Course*): Mr. GOULD. Monday and Tuesday, 4 p. m., Room 8. (2).

Grasty, J. S.
Harry, P. W.

Spanish: (*Commercial Course*): Mr. GOULD. Thursday and Friday, 4 p. m., Room 8. (3).

Bandel, J. M.
Hollander, L. M.
Thomsen, J. J.

History, Politics, and Economics. (115 Students).

Classes meet in McCoy Hall.

Historical Seminary: Professor ADAMS. Alternate Fridays, 8 p. m., Room 25. (19).

Ayer, J. C.
Barnett, G. E.
Brander, W. W.
Cator, G.
Drewry, W. S.
Fisher, F. C.
Groome, P. L.
Hanna, H. S.
Harry, J. W.
Hattori, Y.
Johnson, E. C.
Kilby, B.
Martin, W. E.
Mulford, R. J.
Myers, W. S.
Radcliffe, G. L. P.
Smith, V. E.
Thorson, I. A.
Weaver, C. C.

Greek Politics: Professor ADAMS. Wednesday and Thursday, 11 a. m., Room 25. (18).

Ayer, J. C.
Barnett, G. E.
Cator, G.
Drewry, W. S.
Fisher, F. C.
Groome, P. L.
Hanna, H. S.
Harry, J. W.
Hattori, Y.
Johnson, E. C.
Kilby, B.
Martin, W. E.
Mulford, R. J.
Myers, W. S.
Radcliffe, G. L. P.
Smith, V. E.
Thorson, I. A.
Weaver, C. C.

Educational Conference: Professor ADAMS. Friday, 11 a. m., Room 25. (16).

Ayer, J. C.
Barnett, G. E.
Brander, W. W.
Drewry, W. S.
Groome, P. L.
Hanna, H. S.
Harry, J. W.
Hattori, Y.
Johnson, E. C.
Kilby, B.
Martin, W. E.
Myers, W. S.
Radcliffe, G. L. P.
Smith, V. E.
Thorson, I. A.
Weaver, C. C.

History of Civilization: (*Major History*): Professor ADAMS and Dr. BALLAGH. Monday and Tuesday, 11 a. m., Room 24. (26).

Bandel, J. M.
Beeuwkes, H.
Bernheim, B. M.
Bird, A. R.
Boyer, N.
Bruton, A. W.
Bye, M.
Byrne, H. S.
Deen, E. W.
Duck, R. S.
Flinn, F. B.
Griffith, W. A.
Harris, W. H.
Harry, J. W.
Hollander, L. M.
Johnson, E. C.
Kilby, B.
Kohn, W. I.
Morgan, S. C.
Raffel, H. B.
Riggins, J. A.
Sayler, J. A.
Stein, J. S.
Swindell, W. B.
Tyler, J. E.
Whitman, H. S.

Historical Conference: Associate Professor VINCENT. Friday, 10 a. m., Room 23. (9).

Drewry, W. S.
Eckenrode, H. J.
Groome, P. L.
Harry, J. W.
Kilby, B.
Martin, W. E.
Myers, W. S.
Smith, V. E.
Thorson, I. A.

Protestant Revolution: Associate Professor VINCENT. Tuesday and Thursday, 10 a. m., Room 23. (19).

Brander, W. W.
Drewry, W. S.
Eckenrode, H. J.
Fisher, F. C.
Griffith, G.
Groome, P. L.
Hanna, H. S.
Harry, J. W.
Johnson, E. C.
Kennedy, J. B.
Kilby, B.
Litsinger, W. H.
Martin, W. E.
Mulford, R. J.
Myers, W. S.
Radcliffe, G. L. P.
Smith, V. E.
Thorson, I. A.
Weaver, C. C.

European History: (*Major History*): Associate Professor VINCENT. Thursday and Friday, 11 a. m., Room 23. (22).

Bandel, J. M.
Beeuwkes, H.
Bernheim, B. M.
Bird, A. R.
Boyer, N.
Bruton, A. W.
Bye, M.
Bryne, H. S.
Deen, E. W.
Duck, R. S.
Flinn, F. B.
Griffith, W. A.
Harris, W. H.
Kohn, W. I.
Morgan, S. C.
Raffel, H. B.
Riggins, J. A.
Sayler, J. A.
Stein, J. S.
Swindell, W. B.
Tyler, J. E.
Whitman, H. S.

Modern Europe: (*History-Economics Course*): Associate Profess[illegible] VINCENT. Monday and Wednesday, 10 a. m., Room 23. (32).

Abercrombie, R. T.
Anderson, R. B. T.
Baetjer, H.
Booker, J. M.
Breed, A. A.
Brooks, C. E.
Burrell, J. L. A.
Deen, E. W.
Eager, J. H.
Ewell, J. E.
Foster, F.
Grasty, J. S.
Greene, J. D.
Griffin, J. W.
Hyde, E. P.
James, W. McC.
Kerr, R. C.
Leopold, E. J.
Mackall, L. L.
Manken, H.
McAll, R.
Morgan, S. C.
Purcell, T. N. D.
Riggins, J. A.
Roulston, R. B.
Rous, F. B.
Routh, J. E.
Smith, W. L.
Spencer, E. M.
Stephens, J. C.
Turnbull, B.
West, A. P.

Territorial Policy of the United States: Dr. CALLAHA[illegible] Monday, 10 a. m. (6).

Drewry, W. S.
Eckenrode, H. J.
Kilby, B.
Martin, W. E.
Radcliffe, G. L. P.
Thorson, I. A.

General History Examinations: Dr. BALLAGH. Tuesday, [illegible] a. m., Room 20. (6).

Brander, W. W.
Drewry, W. S.
Groome, P. L.
Myers, W. S.
Radcliffe, G. L. P.
Weaver, C. C.

Southern History: Dr. BALLAGH. Friday, 12 m., Room 20. [illegible]

Drewry, W. S.
Kilby, B.
Krager, W. M.
Martin, W. E.
Weaver, C. C.

Classical and Early European History: (*Minor Histor[illegible]y*) Dr. BALLAGH. Daily, except Tuesday, 10 a. m., Room 20. (18[illegible].

Bandel, B. B.
Bandel, J. M.
Diggs, R. M.
Ford, C. E.
Griffith, W. A.
Guggenheimer, F. L.
Hatch, E. C.
Hill, E. C.
Hill, W. B.
Kirk, W.
Marbury, 'O.
Markell, C.
Pearre, A.
Ranft, C. F.
Schmeisser, W[illegible]. C.
Sharretts, R. [illegible]
Smith, S.
Strouse, E.

Political Conference: Dr. WILLOUGHBY. Alternate Tues[illegible]ays, 8 p. m. (6).

Brander, W. W.
Hanna, H. S.
Johnson, E. C.
Mulford, R. J.
Radcliffe, G. L. P.
Thorson, I. A.

Comparative Constitutional Law: Dr. WILLOUGHBY. Wednesday and Thursday, 12 m., Room 20. (9).

Barnett, G. E.
Brander, W. W.
Cator, G.
Hanna, H. S.
Harry, J. W.
Johnson, E. C.
Kilby, B.
Mulford, R. J.
Radcliffe, G. L. P.

Conference in Parliamentary Law: Dr. Lee. Alternate Thursdays, 12 m., Donovan Room. (50).

Bandel, J. M.
Baldauf, L. K.
Bernheim, B. M.
Bird, A. R.
Booker, J. M.
Boyer, N.
Brady, J. H.
Briscoe, J. S.
Brown, E. B.
Bruton, A. W.
Byrne, H. S.
Constantine, C. W.
Cronin, F. H.
Dapprich, F. R.
Duck, R. S.
Ember, A.
Fishach, L. G.
Griffin, E. J.
Griffith, W. A.
Harris, W. H.
Hatch, E. C.
Hollander, L. M.
James, W. McC.
Kohn, W. I.
Leopold, E. J.
Lowndes, E.
Machen, J. G.
Manken, H.
Morse, R. B.
Mower, F. D.
Noble, E. R.
Norton, E. L.
Powers, H. W. S.
Raffel, H. B.
Rehberger, G. E.
Riggins, J. A.
Sayler, J. A.
Shippen, L. P.
Shreve, O. F.
Snavely, G. E.
Spencer, L. C.
Stein, J. S.
Straus, H. P.
Struth, O. A.
Swindell, W. B.
Tyler, J. E.
Warner, H. M.
West, A. P.
Whitman, H. S.
Wolf, M. W.

Elements of Public Speaking: Dr. Lee. Assembly Room.

Wednesday, 1 p. m. (19).

Bandel, B. B.
Beasley, E. B.
Hildt, J. C.
Hoge, J. F. D.
Kenney, W. C.
Kirk, W.
Markell, C.
McGlone, B.
Murphy, L. C.
Pinkerton, T. C.
Putts, B. S.
Ranft, C. F.
Schmeisser, W. C.
Sharretts, R. C.
Sisco, G. E.
Slemons, J. A.
Smith, S.
Sneeringer, W. J.
Wroth, P.

Thursday, 1 p. m. (18).

Barnett, E.
Buttner, W. J.
Campbell, J. G.
Diggs, R. M.
England, J. T.
Golladay, R. E.
Guggenheimer, F. L.
Hand, J. P.
Hill, E. C.
Hill, H. D.
Hutzler, L. S.
Knapp, A. M.
Law, H. B.
Marbury, O.
Moore, R. E.
Pearre, A.
Reynolds, W. F.
White, L. J.

Friday, 1 p. m. (18).

Beeuwkes, H.
Bernheim, E. P.
Cameron, P. J. S.
Deen, E. W.
Dew, A. G.
Gillespie, H. C.
Heald, H. B.
Hildebrandt, L. F.
Koppelman, W. H.
Macht, D. I.
Mason, S. T.
Myers, C. A.
Ogle, M. B.
Pels, I. R.
Reider, C.
Stone, H. B.
Strouse, S.
Wolman, S.

UNIVERSITY SCHOLARSHIPS.

The Board of University Studies, at their meeting of January 10, awarded University Scholarships for the current year to the following persons:—

H. T. Archibald,
W. C. Coker,
A. H. Ewing,
J. C. W. Frazer,
N. E. Gilbert,
R. Guernsey,
F. C. Hicks,
D. W. Horn,
G. C. Martin,
W. E. Martin,
C. R. McInnes,
L. W. Miles,
C. A. Mosemiller,
A. M. Reese,
C. S. Smith.

The course of lectures before the Young Men's Christian Association, provided by Mr. Eugene Levering, were given this year by the Reverend W. H. P. Faunce, D. D., President of Brown University, whose subject was the "Use and Abuse of the Bible." The lectures were given in Levering Hall, March 13, 15, 16.

Mr. Frederick E. Ives, of Philadelphia, inventor of the "three color system" of photography, gave an illustrated lecture on "color photography," before the scientific association of the University, in McCoy Hall, March 9, at 8 p. m.

Public Meetings recently held in the University Buildings:

Annual public meeting of the Charity Organization Society of Baltimore, in McCoy Hall, November 13.

Annual meeting of the Baltimore Society of the Archæological Institute of America, in the Donovan Room, November 16.

A lecture by Mrs. Olive Thorne Miller, before the Maryland Audubon Society, in Levering Hall, November 17.

Public meetings of the Municipal Art Society of Baltimore, with lectures by Mr. E. H. Blashfield, of New York, and Mr. George Kriehn, of California, in McCoy Hall, December 13 and 14.

Sessions of the Baltimore County Teachers' Institute, in Levering Hall and McCoy Hall, January 2–5.

Monthly meetings of the Maryland Folk Lore Society, in the Donovan Room, January 26, February 23, March 23.

Presentation to the University, by the Maryland Society of the Colonial Dames of America, of a mural tablet commemorative of the founding by Governor Nicholson of the first free school in Maryland in 1691,—in McCoy Hall, March 24.

The annual prize debate between members of the Senior and Junior Classes, and public speaking by members of the Freshman Class, in McCoy Hall, March 27.

Annual meeting of the Maryland State Federation of Women's Clubs, in Levering Hall, March 29.

Annual meeting of the Municipal Art Society of Baltimore, followed by a lecture by Mr. Truman H. Bartlett, of Boston, on Barye, the sculptor, in McCoy Hall, March 31.

STUDENTS IN THE JOHNS HOPKINS MEDICAL SCHO

Candidates for the Degree of M. D. (211).

Fourth Year. (45).

Akerman, J.
Allen, H. W.
Austin, M. F.
Beale, A. E.
Bettmann, M.
Briggs, E.
Brown, L.
Brülle, H.
Burnam, C. F.
Chace, E. S.
Chittenden, A. S.
Christian, H. A.
Dancy, W. R.
Eggers, A. H.
Evans, H. C.
Fairbank, R.
Farrar, C. B.
Fisher, A. L.
Fisher, W. A.
Fletcher, H.
Flint, J. M.
Healy, W. P.
Hendrickson, W. F.
Hewlett, A. W.
Kellogg, W. C.
Kyes, P.
Lebus, L.
Lewis, W. H.
Little, H. W.
Lowell, E. L.
MacCallum, J. B.
Marvell, M. W.
Meltzer, C. R.
Mosher, C. D.
Myrick, H. G
Oliver, E. S.
Rand, R. F.
Reed, D. M.
Rusk, G. Y.
Sabin, F. R.
Sowers, W. F
Stone, E. A.
Warren, M.
West, J. M.
Woolley, P.

Third Year. (56).

Atherton, A. M.
Baetjer, F. H.
Baldwin, W. D.
Berry, J. M.
Blakeslee, W. H.
Bloombergh, H. D.
Boggs, T. R.
Bosley, J. R.
Bunting, C. H.
Butler, J. I.
Carey, H. W.
Chowning, W. M.
Comer, R. T.
Connor, G. L.
Connor, R.
Drake, G. S.
Dutcher, A.
Fowler, H. A.
Gay, F. P.
Graham, N. D.
Hall, G. W.
Hamman, L. V.
Hastreiter, R. F.
Hathaway, J. H.
Hitzrot, J. M.
Holden, G. R.
Hume, E. H.
Johnston, W. B.
Kauffman, B. B.
Kaufman, H. M.
Lamson, T.
Lewis, D. M.
Long, M.
Longcope, W. T.
Lyle, A. G.
Maddren, W. H.
Moore, E. S.
Parker, H. P.
Rubel, M. J.
Salter, J. C.
Simis, M. P.
Slemons, J. M.
Smith, H. M.
Spratt, C. N.
Stein, G.
Steinfeld, A.
Swett, C. M.
Ulrich, H. L.
Underhill, A.
Walker, M.
Warfield, L.
Warren, G.
Watts, S. H.
Wells, E. A.
Wells, M.
Winne, C. K.

Second Year. (60).

Auer, J.
Briggs, J. B.
Browne, B. B.
Bruns, R. M.
Bryan, W. M. C.
Bush, C.
Churchman, J. W.
Clarke, T. W.
Cook, H. W.
Coons, J. J.
Dohme, G. C.
Dolley, D. H.
Dudley, H.
Duffy, R.
Dunlop, J.
Eddy, D. L.
Erving, W. G.
Ferry, N. S.
Foster, N. B.
Francis, W. W.
Frankenthal, M. A.
Glenny, W. H.
Grant, J. F.
Hardy, C. F.
Haviland, M. L.
Haynes, M. S.
Hirshberg, L. K.
Horst, C. H.
Hyman, S.
Jelke, W. F.
Jones, T. M.
Karsted, A.
Kimball, A. H.
Lehr, L. C.
L'Engle, E. M.
Litchfield, G. V.
Lootz, E.
Ludlum, S. D.
MacGregor, G. M.
Marshall, S. A.
McFarland, J. S.
Meisenhelder, E. W.
Meisenhelder, J. E.
Ochsner, H. W.
Pelton, G. I.
Pratt, F. H.
Reede, E. H.
Riggins, E. N
Rogers, C. P.
Scholl, G. B.
Silverberg, M
Simpson, J. N
Steele, H. M.
Tallant, A. W
VanArsdall,
VanDenburg,
Wight, O. B.
Williams, C.
Williams, D.
Wright, C. B.

First Year. (50).

Barker, M. L.
Bassett, V. H.
Bennett, R.
Bixler, L. C.
Blauvelt, E. H.
Brush, C. E.
Chatard, J. A.
Chinn, G. E.
Clark, A. H.
Cornell, W. B.
Dewey, E. G.
Edwards, R. T.
Fayerweather, R.
Fischer, J. S.
Gaenslen, F. J.
Gaines, L. M.
Geraghty, J. T.
Goldsborough, F. C.
Haskell, L. W.
Hirschfelder, A. D.
Hopkins, R.
Hunter, P. S.
Hutchins, H. T.
Jones, C. L.
Keidel, A.
Kingsbury, H. P. D.
Lazenby, M.
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Manning, W. S.
Marshall, W.
McClintock, R. W.
Miller, R. T.
Morse, M. E.
Moulton, W. B.
Neagle, H. B.
Rainforth, S.
Riley, R. F.
Robinson, G.
Schmitter, F.
Schultz, O. T.
Smith, W. H.
Stevens, A. R.
Tayler, L.
Thompson, W
Travis, C. H.
Watson, F. H
Young, C. W.

Physicians Attending Special Courses. (20).

Carroll, J. J.
Curtiss, R. M.
Fearn, T.
Hamilton, M.
Hartigan, J. W.
Harward, J. J.
Kerr, A. T.
Kibbe, M. E.
Latimer, C. W.
McDowell, G. K.
McGlannan, A. W., Jr.
Meikle, T. D.
Middleton, J. I.
Miller, W. McN.
Newton, D. H.
Otis, F. J.
Potter, C. H.
Somers, G. B.
Thompson, W
Wilson, G.

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PA

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Geology, - - - - - - - - - - - - - - -
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Medical School, - - - - - - - - - - - - - -
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is journal was commenced in 1878, under the editorial direction of ssor Sylvester. Professor Simon Newcomb is now the Editor. Twenty-olumes of about 400 pages each have been issued, and the twenty-second progress. It appears quarterly. Subscription $5 per year. Single ›ers $1.50. A very few complete sets remain. These will be sold for per set.

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e publication of this journal commenced in 1879, under the editorial tion of Professor Basil L. Gildersleeve. Twenty volumes of about ›ages each have been issued, and the twenty-first is in progress. It ars four times yearly. Subscription $3 per volume. Single numbers Sets are sold at $60 each.

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HOURS FOR LECTURES AND RECITATIONS, SECOND HALF-YEAR, 1899-1900.

	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
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5					Old Testament Lit. (Haupt.)	

26 On high lift up your eyes, and see the Creator of the stars.
Their host He marshals in order, calling them all by name;
Through His power and mighty strength, not one remains behind.

27 How canst thou say, O Jacob, how declare, O Israel,
My course is unheeded by JHVH, unnoticed by God are my claims!
28 Hast thou not known, hast thou never heard?
The Eternal God is JHVH, the Creator of all the earth.

He does not faint nor weary, inscrutable is His mind.
29 Vigor He gives to the faint, power to those without strength.
30 Though youths grow faint and weary, and youthful vigor fail,
31 They who trust in Him gain strength, and raise their wings like eagles.

The Biblical Ephod. By T. C. Foote.

[Abstract of a paper read before the University Philological Association, Feb. 16, 1900.]

It is generally supposed that the Biblical ephod was some kind of long white surplice; but 2 Sam. **6**, 14 ff., where David is depicted as dancing before the Ark, girded with a linen ephod, and where the whole point of the story turns on the extreme scantiness of David's covering, shows the error of the popular view. The ephod is mentioned in seventeen sections of the O. T., the whole number of passages being forty-four. These must be examined in chronological order if we wish to trace the original conception of the ephod. The passages cover a period of about 400 years, from 800 to 400 B. C., and it is quite possible that the ephod had an entirely different meaning in post-Exilic times from what it had in Ancient Israel. One half of all the passages where the ephod is mentioned belong to the Priestly sections of Exodus and Leviticus, which are not older than 500 B. C. The other half are in the historical books and belong mostly to the oldest stratum known as the Judaic document, which was composed about 800 B. C. The popular idea of the ephod associates it with linen, but the linen ephod is mentioned in only 4 out of 17 sections. In Jud. **8**, 27 (one of the earliest mentions of the ephod) Gideon got together over 70 lbs. of gold *and made an ephod thereof*—this ephod may have been a gold band for an image. There is no parallel passage proving that the ephod was an image. Prof. Wilhelm Lotz, in his article on the ephod in the *Realencyklopädie für protestantische Theologie und Kirche*, third edition (Leipzig, 1898), strongly opposes the view that Gideon's ephod was an idol. In Jud. **17** and **18** 'the man Micah' made an ephod and teraphim, and put them in a sanctuary, and some traveling Danites stop in and receive oracular communications. The teraphim may be understood as ancestral images, and the ephod in some way associated with them in divination. The Vulgate on this passage has, *et fecit ephod et theraphim, id est, vestem sacerdotalem, et idola*—an interpretation probably suggested by the much later account in Exodus.

In the narrative alluded to above (2 Sam. **6**, 14) King David is *girded* with an ephod, not *wearing* it. The same expression occurs in three other places, and the Latin term is *accinctus*, Greek *περιεζωσμένος*, Heb. חגר. This is the stem from which the word for *aprons* in Gen. **3**, 7 is derived; it does not suggest a garment, but a girding. If ephod were always associated with חגר, we might be justified in concluding that it was a girded loin cloth; but such is not the case. Twice it is connected with teraphim (Jud. **17**, 5; Hos. **3**, 4), once (Jud. **8**, 27) it is placed somewhere, once (1 Sam. **21**, 10) it is on the floor and Goliath's sword is *behind it*. Twice (1 Sam. **23**, 9; **30**, 7) it is *brought near* to be used in divination. When Abiathar flees to join David he takes the ephod in his hand (1 Sam. **23**, 6). Nothing in these passages suggests a garment.

There are three places, however, where the English Versions say, *wearing an ephod*. The verb rendered *wearing* is Heb. נשׂא, Gk. *αἴρω*, Lat. *portare*. *Αἴρω* and *portare* never mean *wear* as a garment. נשׂא is one of the commonest verbs in Hebrew and never means *wear*, unless it be made for these three passages. These verbs mean *to bear, to carry;* and we shall be obliged to assume a false rendering in English, arising from a mistaken idea of the ephod (as, *e. g.* when St. Jerome in one passage, 1 Sam. **22**, 18, renders *vestitos*), or else understand *wear* in the sense of *bear*, as country people *wear* a potato in the pocket to keep off rheumatism. However explained, the word is misleading; and the phrase *wearing an ephod*, together with the anachronism of supposing the ephod of Exod. **39** to have been known before the Exile are largely accountable for the popular misconception of what the ephod originally was.

Having seen that there is not a vestige of evidence that the ephod in ancient Israel was a garment, but rather something that might be carried, placed, brought near, and girded on the loins, we proceed to ascertain what use the ephod served. In about half the places where it is mentioned, the ephod is connected more or less directly with divination. Apart from this no use is even remotely suggested. We may note, however, that it always had a religious significance. *Carrying an ephod* is synonymous with priest or sacred minister. This leads to the inference that, as one of the chief duties of a priest was to obtain divine oracles, so the ephod, his constant companion, was a medium of divination. Micah's ephod and teraphim were used for divining. David, on two occasions (1 Sam. **23**, 9; **30**, 7), used the ephod for the same purpose and received the sort of answer one might get from lots. These passages make it plain that the ephod was a medium of divination, and the connection with teraphim is an additional proof. Divination by sacred lots was a general and uncondemned practice in Israel. Hosea (740 B. C.) censures the people for the idolatrous use of images, but has apparently no objection to the use of ephod and teraphim (Hos. **3**, 4). What the teraphim were is not perfectly plain. The Greek word in the passage just referred to is *δῆλοι*, *plain speakers*, perhaps. In the prophet Zechariah **10**, 2 we read *The teraphim have spoken vanity, and the diviners have seen a lie.* Here the Greek for teraphim is *ἀποφθεγγόμενοι*, the *plain speakers*, and they are evidently a medium of divination. Then again, in 1 Sam. **14**, 41 Saul uses the sacred lots, the Urim and Thummim as may be seen from the LXX.[1] In drawing the lot, Saul says, *Give Thummim*, and the Greek Bible reads, *δὸς δήλους*, the same word used in Hosea for teraphim. So there is ground for thinking that the teraphim, if not identical with the Urim and Thummim, were used for the same purpose, and though at times they seem to have varied much in size, they are associated with divination from first to last.

It only remains to notice the latest passages, in Exodus and Leviticus, where the ephod is described. Canon Driver, in his article in Hastings' Dictionary of the Bible, takes these passages first (though he assigns them to 500 B. C.) and consequently can arrive at no conclusion. In the Priestly Code we find the ephod as it was conceived to be after the Captivity, when the Jews had probably lost all knowledge of the ancient ephod, as they had of the use of the Urim and Thummim (see Ezra **2**, 63). So we need not be surprised if we find the ephod no longer *carried* or *girded on the loins.* It appears as a humeral appendage coming to the waist before and behind, and bearing on the front part the breastplate containing the Urim and Thummim, which was securely fastened to it. A long robe is worn with the ephod, and it is said, in the account in Chronicles of David dancing before the Ark, that he had on this robe. But the Book of Chronicles was not written before 330 B. C. The story of Michal does not appear in the version of the Chronicler. It is to be noted, however, that the ephod of post-Exilic times is chiefly made of gold, and is always associated with divination.

We may therefore conclude that the ephod of pre-Exilic times was a receptacle or bag, of gold or cloth, probably containing the sacred lots; used habitually for divination; frequently girded upon the loins; and always giving the bearer a sacred character. According to Professor Haupt, who pointed out to me the meaning of ephod in 2 Sam. **6**, the best translation for the Heb. *ephod* would be *scarf*. This would suggest an article of dress worn about the waist or the neck, or over the shoulders (cf. the Roman Catholic *stole*) while the corresponding Old High German word *scharpe* means *pocket, pouch* = Old French *escharpe*, a pilgrim's scrip, or wallet, hanging about the neck. Lagarde's explanation of *ephod* in his *Mittheilungen*, vol. **4**, p. 17 is untenable.

A Modern Cuneiform Congratulatory Message. By W. B. McPherson.

[Abstract of a paper read before the University Philological Association, Feb. 16, 1900.]

The Oriental Seminary of the Johns Hopkins University has paid particular attention to the study of Cuneiform Epistolary Literature. Dr. Johnston's thesis was devoted to this special branch of Assyriology, and he has supplemented his inaugural dissertation by a number of important pers bearing on the same subject. The Notes on the English translation Joshua (pp. 47–55) in the Polychrome Bible edited by Professor Haupt ntain an elaborate, illustrated excursus on the famous cuneiform dispatches own as the Tel el-Amarna Tablets, which represent a part of the official rrespondence of Amenophis III. and Amenophis IV. of Egypt with the ngs of Babylonia and other states of Western Asia, and especially with e Egyptian officials and subject-allies in Palestine, thus throwing a flood light on Egypt and Western Asia, and above all on Palestine, about 00 B. C., probably some time before the Exodus and Conquest.

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[1] Compare notes 12 and 53–62 to Professor Haupt's *Babylonian Elements in the Levitic Ritual*, vol. xix of the *Journal of Biblical Literature* (Boston, 1900).

Nor has the interest of the Oriental Seminary been confined to *ancient* neiform letters; and although Assyrian may never again become the nguage of diplomacy, in which capacity we find it in the Amarna tablets, t it has occasionally been employed during the past decade for several ngratulatory messages, letters of introduction, etc.

When the Continental publishers of The Polychrome Bible, the well own house of J. C. Hinrichs, of Leipzig, celebrated, on the 1st of August, 91, the 100th anniversary of the establishment of their firm, they received congratulatory message engraved, in genuine Assyrian style, on a real ay tablet like the tablet containing the modern reproduction of the abylonian account of the Deluge, published under the auspices of the niversity. The text of the Hinrichs tablet was composed by the head of e Semitic department of the Johns Hopkins University, and accompanied a German translation, prepared by Professor Friedrich Delitzsch, of erlin. A transliteration of the cuneiform text with an English translaon by Professor J. D. Prince, of New York University, is published in e Johns Hopkins University Circulars, No. 98, May 1892, p. 92.

The famous *Menu* of the Eighth International Congress of Orientalists, ld at Stockholm in 1889, which was accompanied by a unique collection original poems in the various Oriental languages, furnished by leading ecialists, describing the several courses of the banquet, contains also a neiform poem on the Babylonian Noah's first venture in the manufacture wine (*cf.* Gen. **9**, 20–27). This interesting text, in the style of the abylonian Nimrod Epic, tells how, after the Deluge, the Babylonian oah, Xisuthrus, complained to the gods that he could no longer drink ater which had been polluted by the drowning of so many wicked men d beasts. In answer to his prayer he was given, by the god Ea, a iraculous liquor called BUR-DU. In the fervor of his piety Xisuthrus ceived the gift of the gods with such open heart that finally his divine ardians were obliged to send their pious votary a magical antidote, consting chiefly of some effervescent water and a salted fish, to counteract e effects of the attack of the evil demon known in Babylonian demonlogy as KA-TER.

The latest cuneiform production, so far as I know, is a congratulatory essage written on the 30th of Dec., 1899, which was the 25th anniversary the election of President Gilman to the Presidency of the Johns Hopkins niversity. I append a translation of this text and a transliteration of he cuneiform original.

TRANSLATION.

To the great chief,
Dâni'ilu the son of Gilmânu
thy servant Pa'ûlu the son of Ha'uptu:

A hearty, hearty greeting to my lord!
On the auspicious day when 25 years ago
thou wast chosen
to the Presidency of the great school;
the house of teaching and instruction,
the seat of the Lord of Inscrutable Wisdom,
established in the Monumental City—
when thou wast selected by the wise men
whom the Prince of Merchants,
Shunsu the son of Hupkinsu,
had entrusted with his great wealth,
for the benefit of knowledge and righteousness,
to teach human kind truth—
on this day may the Lord of Heaven and Earth
grant length of days, health of mind and body
to the great chief, my lord.
May He extend thy rule to the end of days!
I pray daily for the life of the chief, my lord,
May it be well with thee in the new year!
May the Lord of Heaven and Earth prosper the work of thy hands;
may He establish prosperity in the home of the great school.
Nebo, the Scribe of the Universe,
hath joyfully looked on thy deeds.
Thou hast erected a monument above all monuments of the Monumental City.
The splendor of thy name is established for ever.

Written upon the swift cars
of the road of iron,
between the City of Brotherly Love and the Monumental City,
on the 30th day of the 12th month of the year of our Lord 1899.

TRANSLITERATION OF CUNEIFORM TEXT.

1 *Ana ašaridi rabî*
Dâni'ili mâr Gilmâni
arduka Pa'ûlu mâr Xa'upti.
Lû šulmu ana belî'a adanniš adanniš!
5 *Ina ûmi mitgari ša ultu XXV šanâti*
tannamiru atta
ana ašaridûti ša bît mummu rabî
bît šûdî u šulmudi
šubat Bel nîmeqi
10 *ša ina âl Çalmâni uktînûni*
ša uttûka amelûti engûti
ša malik tamkare
Šunsu mâr Xupkinsi
niçirtašu kabitta ušadgilû pânûšun
15 *ana ruddî berit umi u mîšari*
ana šûxuz niše kettu^{m}—
ina ûmi annî Bel šame u erçiti^{m}
arâku ûme, ṭûb libbi, ṭûb šîri
ana beli rabî ašaridî'a liqîš
20 *ašaridûtka ana çât ûme lušâlik!*
Ûmûssu ana balâṭ napšâti ša ašaridî'a uçallâ
lû šulmu ana kâša ina šatti eššeti
libbuka ka'ânâ-ma lû-ṭâba
Bel šame u erçiti^{m} *šipir qâtâka lišallim*
25 *šulmu ina bît mummu rabî lipqid*
Nabû dupšar mîma šumšu
epšetika xadîš ippalis
çalmu tazqup
elî çalmâni kâlišunu
30 *ša âl Çalmâni*
melamme šumika ana balâṭ ûme rûqûti taltâkan.
Šaṭîr ina elî rukûbe xitmuṭûti
ša sullî barzilli
ina berit âl Narâm-axûti u âl Çalmâni
35 *ina ûm XXX ša arax XII šatti Belini MDCCCXCIX.*

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NOTES FROM THE BIOLOGICAL LABORATORY.

EDITED BY PROFESSOR WILLIAM KEITH BROOKS.

ations on the Gametophyte and Embryo of n Distichum, Richard. By W. C. COKER.

ial from which most of my results were obtained was collected ntervals from Baltimore, Maryland, and Hartsville, South Caro- ct seed are rarely found in Baltimore, and all stages after May en from South Carolina material.

rly part of the year before their maturity both male and rs are easily distinguishable, the male flower being, however, more developed on the 1st of October than the female. At e pollen sacks are large and, archesporium and tapetum are uishable. In the female flower the nucellus may be seen as a erence directly in the axis of the sporophyl, while the integu- lacental cushion only appear later. Before the middle of ntegument has reached the tip of the nucellus and a group of l at the base of the latter may be distinguished as primary n. When the pollen is shed a week or two later the integu- t twice as long as the nucellus and the channel of the micro- eely by a wide mouth. The placenta now appears as a con- ominence just above the ovule, being most developed in the n of the sporophyl. The micropile now begins to close by the f the inner cells of the integument near its tip and by the the number of cells at this point. By May 10th the arche- reached its full size and is surrounded by several layered ich is, however, not closely demarked from it. The arches- at the very base of the nucellus and in form and position is at of Juniperus, Callitris and other Cupressineae. One of r near the center of the group begins to enlarge and the other rchesporium become loosened and show signs of disintegration, re is a division of a mother cell into four macrospores has not ined.

first of June the macrospore has reached its full size and rly the whole length of the much-enlarged nucellus. The till confined to a thin peripheral layer in the sac, but their pid and a cellular endosperm soon begins to form, its growth apid at the micropilar end. After the endosperm has become issue, the nuclei, which are small in comparison to the cell to divide, apparently amitotically, and the cells become multi- many as 6 or 7 nuclei being not infrequent in one cavity. he tip of the integument has become much hardened by the of thick, pitted walls in the cells of that region.

th, the mother cells of the archegonia have become greatly nd the neck cells are being cut off. The archegonia are lose contact in a group at the tip of the prothallus and soon come to lie in a deep depression just as in the Cupressineae. After fertilization this depression is closed by the growing in of the nucellus over the archegonia. The neck cell divides into four as in Juniperus. Just before fertilization, which occurs about a week later, a ventral canal cell is cut off and lies as a mass of nuclear matter just under the neck cells and usually near the wall of the archegonium. The female pro-nucleus remains near the tip of the oosphere and is in this position at the time of fertilization. The mature oosphere contains two masses, one at each end, which stain like the other cytoplasmic contents, but, by their greater density and distinct limits, are very conspicuous.

The lower ends of all the archegonia and the outer edges of the peripheral ones are bordered by a distinct layer of densely granular cells, which doubtless helps to nourish the oosphere, as in these regions the wall between the two is furnished with large pits. These pits have not been carefully studied, but seem to resemble those of the Abietineae, Taxaceae and Cycadeae in function.

The pollen sprouts almost immediately on reaching the nucellus, and the tube grows with little or no interruption until it touches the still nearly empty embryo-sac about the 1st of June. The early stages of sprouting have not been observed, but by May 10th the tube has reached about half way to the embryo-sac and contains three nuclei near its growing point. These are probably the pollen tube nucleus, the stalk nucleus, and the body cell nucleus. When the pollen tube has reached the embryo-sac, the three nuclei are seen in a group. The body-cell nucleus is somewhat larger than the other two, and lies just behind them. As many as three or four tubes may push their way into the funnel over the archegonia, as may also happen in Juniperus and Thuja. The body nucleus increases rapidly in size and becomes surrounded with a mass of dense protoplasm, which, before division, is separated from the other protoplasm of the tube by a sharp and distinct surface. Just before fertilization the male nuclei divide into two as in other cases. All the nuclei in the pollen tube pass into the archegonia in fertilization, but the tube and stalk nuclei are undergoing disintegration at the time and can not be certainly located in the oosphere; but, in connection with the broken-down neck cells, form a more or less evident granular mass in the tips of the archegonia after the the collapse of the tube. Both male pro-nuclei may enter into the same archegonium, in which case one remains at the tip and is evident even after several divisions of the oospore. The male and female pronuclei come in contact near the upper end of the archegonia, and are partly surrounded at this stage by a dense mass of cytoplasm the origin of which is at present obscure. The nuclei travel together towards the base of the oospore and the cytoplasmic mass gradually draws itself entirely around them. They do not fuse completely until the bottom is nearly or quite reached.

The first division of the oospore does not seem to be constant in direction, the wall formed being either perpendicular to the long axis of the archegonium or more or less inclined to it. In the next stage obtained, the pro-embryo consists of three tiers of four cells each. In the upper tier no cell walls are found, or if so they are soon dissolved, so that the nuclei lie free in the cavity of the archegonium. The pro-embryo in this stage is very like that of Juniperus, as it is also a little later, when the number of tiers has increased to four and the second tier from the top has greatly elongated so that the embryo is forced out into the endosperm.

The results so far arrived at point to the conclusion that in the stages of its development described above Taxodium agrees closely with the Cupressineae, and differs widely from Sequoia as described by Shaw.

PLANTS, A TEXT-BOOK OF BOTANY.[1]

A Review by D. S. Johnson.

The conception and plan of Part I of the book were evidently guided by the desire to illuminate the facts of plant structure by the results of modern ecology.

Of the pre-eminent suitability and interest of these facts for beginners and for those who never go far beyond this stage there can be little doubt, for, as the author suggests, these are the phenomena which are open to observation everywhere without apparatus or artificial experimentation. Neither can it come amiss for those who expect to pursue the subject further to become thoroughly impressed at the start with the fact, which is easily lost sight of in reading many text-books of botany, that the important thing is not structure as such but structures as efficient tools or organs for carrying on the work of the plant.

Of the several recent attempts to present in a form suitable for beginners the primary facts of this relation of structure to function, and thus to environment, the present seems to the reviewer to be the most satisfactory. The difficulty hitherto experienced has been that of attaining a clear logical arrangement, with a *raison d'être* which shall be to some extent at least evident to the student, an advantage that, whatever its other shortcomings, has been possessed by the formal structural botany of the past.

As to the exact order in which the various topics should be taken up there is much difference of opinion, but the naturalness with which each topic here leads the student on to the next is sufficient evidence that the author's way is at least *one* of the good ones.

In the second half of the book we find a brief but clear presentation of the life histories of the chief groups of plants and short chapters on histology, physiology and ecology.

It is very gratifying to find the author using the term "vegetative multiplication," for those modes of forming new individuals where (usually) slightly modified vegetative parts are concerned, instead of confusing the primarily distinct adjectives "vegetative" and "reproductive" as has been frequently done of late by combiniug them into one word to describe the above mentioned process. It is doubtful also whether the substitution (on p. 110, Part I) of "egg" for fertilized egg or oospore is a wise one, since this incurs the risk of causing confusion later on when the proper term is used for the same thing.

In speaking of secondary growth (on p. 288, Part II) a few words might have suggested the origin of secondary pith rays, which must, as the discussion stands, prove troublesome puzzles to the reader who seeks here an explanation of the structure of common woody stems.

The choice of a liverwort which will show the essential features of development in this group and at the same time be generally obtainable is perhaps difficult, but it is certainly true that making Marchantia the principal type introduces exceptionally complicated structures, at a point where the essential new features are sufficiently difficult to grasp. Moreover, it is apt to become the typical liverwort in the student's mind and so to partially obscure the close resemblance of the life-history here to that of the mosses. The reviewer believes that the substitution of some species of the common genera Pallavicinia, Pellia or the foliose Scapania, Lophocolea, etc., would best serve the end in view in a brief study of the group.

Finally in the illustration of the book both author and printer have been highly successful. The figures of toadstools copied from Gibson are sufficient evidence that the artistic quality may be a decided addition to a scientific drawing when combined with a proper degree of accuracy, while in the many original drawings that replace certain standard figures it is pleasing to find other merits than mere newness to warrant the substitution.

On the Embryo-sac of Saururus Cernuus. By Duncan S. Johnson.

The development of Saururus has been studied during the past winter in connection with work on the Piperaceae. The material used was obtained chiefly at Beaufort, N. C., while the writer was at the U. S. F. C. laboratory there during the summer of 1899. The points especially studied are the development of the flower and fruit and the sprouting of the seed. The flower, which consists of four carpels and six stamens on the upper surface of a spoon-shaped bract, develops in a manner like that described by Schmitz for the Piperaceae. The ovules are two in each carpel of which but one matures to a seed.

The primary mother cell of the embryo-sac is hypodermal and forms a single tapetal cell above. It then divides to three potential macrospores of which the lower becomes functional. The nucleus of this divides to eight in the usual way and from these are formed the typical egg apparatus, endosperm nucleus and three evanescent antipodals.

After fertilization the egg remains quiescent for some time and the synergids persist indefinitely. After the first division of the endosperm nucellus one of the daughter nuclei remains in the upper end of the now flask-like embryo-sac, while the other moves down into the body of the flask and a wall is formed across the lower end of the neck separating the cavity of the embryo-sac into two. The lower nucleus becomes very large and apparently controls the, at first rapid, encroachment of the basal portion of the embryo-sac upon the tissue of the nucellus, but never divides further and degenerates before the seed is ripe.

The upper nucleus continues to divide and forms a cell wall immediately after each division. In this way the neck of the embryo-sac is soon filled and then by lateral growth the endosperm swells out to fill the whole upper pointed end of the seed, like a double cone, with the lower end reaching down one-fourth of the length of the seed to the body of the flask-like embryo-sac cavity, which body is filled only with a lightly staining apparently slimy substance. All the other space within the seed coats is filled by the densely stored tissue of the perisperm. The embryo begins to develop before the endosperm has widened much. The first division is transverse and when the seed is ripe the embryo has just begun to show a heart-shaped form, with the very short suspensor and blunt root above and the cotyledons showing as two very short lobes below, the whole being surrounded then by six or more layers of endorsperm on all sides and below.

In this condition the seed rests, surrounded by the spongy carpel and outer integument and a principal seed coat formed by the much thickened outer layer of the inner integument.

At sprouting the endosperm bursts through at the tip of the seed as a whitish papilla, within which is a cavity containing the embryo. The latter soon pushes its root out at the tip of the endosperm papilla and bends down to the soil. The tips of the oval cotyledons are tightly clasped by the endosperm and remain attached while the whole fruit is raised from the ground.

The endosperm expands within to absorb all of the perisperm and the swollen tips of the cotyledons crowd the thin endosperm out against the food supply.

In conclusion then the structure of the flower and of the sporophyte in general indicates relationship with the Piperaceae. The embryo-sac is typical while the mode of formation of the endosperm and the small amount of it in the ripe seed is found also in such an evidently distantly related family as the Nymphaeaceae.

The behavior of the endosperm at sprouting is unusual, but we may regard it as completing during sprouting, the function of breaking down the nucellus for the use of the embryo, which in such seeds as those of Phaseolus, Pisum, etc., is completed before the seed ripens.

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[1] *Plants, A Text-book of Botany.* By John M. Coulter, A. M., Ph. D. Head of the department of Botany of the University of Chicago. New York, D. Appleton & Co., 1900. Part I, Plant Relations, pp. 264; Part II, Plant Structures, pp. 348.

Embryo-sac of Peperomia Pellucida. By DUN-JOHNSON.

aterial of various Piperaceae collected in Jamaica in 1897 by the
Humphrey included an abundance of well preserved material of
species. The following abstract gives the most important results
study of this material.

velopment of the flower is essentially as described by Schmitz. The
nsists of a top-shaped bract in the axil of which is borne a single
th a single stamen on each side. The single orthotropous ovule has
ntegument and closely fills the cavity of the ovary.

imary archesporial cell is single and subepidermal. It cuts off a
etal cell above and then immediately develops to the embryo-sac.
eus of the embryo-sac divides by mitosis to sixteen similar nuclei,
d about in the peripheral layer of cytoplasm. Two of these nuclei
found at the upper end of the sac with a rather larger portion of
about each. The larger of these two nuclei with its cytoplasm
egg, the wall of which is at first very delicate and indistinct. The
ms to play the part of a synergid and it likewise has no distinct wall
uch later stage.

ut the time the pollen tube reaches the egg eight of the remaining
peripheral nuclei collect in a compact group, located near the
basal wall of the embryo-sac or central and often just below the egg.
e male and female nuclei fuse these eight nuclei fuse together com-
nto one large nucleus which from this time behaves like the endo-
cleus of the ordinary Angiosperm embryo-sac.

ucleus begins to divide before any change is visible in the egg.
spindle formed by the endosperm nucleus is transverse and the
which immediately forms from the spindle fibres stretches from
vell defined wall of the fertilized egg to the base of the still spheri-
yo-sac. The two endosperm cells thus formed divide further as
ent goes on still in the latest stages seen, probably nearly ripe
re are fifteen or twenty endosperm cells forming a single layer
e embryo except above it. The latter at this time consists of fifteen
ells reaching down nearly half way to the base of the embryo-sac,
le synergid persists even to this stage and remains distinct from
embryo and endosperm.

maining six peripheral nuclei are seen at this stage to be flattened
e wall of the but little enlarged embryo-sac by the endosperm cells
signs of degeneration.

dosperm cells appear at this time to have protoplasmic contents
the whole tissue of the relatively much enlarged nucellus is
acked with starch.

sults here given agree with those recently published by Campbell,
orm up to the sixteen nucleate stage of the embryo-sac. But he
synergidae and interprets the group of eight nuclei as probably
s, which he thinks separate again later. He also interpreted as
he embryo the mass of endosperm cells which finally fill most of
yo-sac and therefore concludes that there is no endosperm.

thor hopes in the near future to be able to study the sprouting of
in this plant and thus to discover whether the part played by this
endosperm at that time is such as to demonstrate this as its true
.

r of Appearance of the Mesenteries and Septa Madreporaria. By J. E. DUERDEN.

the Madreporaria the number and arrangement of the septa
e the most fundamental characteristic, as is the case with the
ies among the Actiniaria. Often, however, so many variations
ing irregularities occur, even in forms which are otherwise closely
hat their value for taxonomic purposes has been much impaired.
been all the more forcibly impressed since it has been demonstrated
l instances that the adult arrangement may be of a type different
in the early stages. The tendency to diminish the importance of
l plan has reached its climax in the attempt of Quelch and others
ute the old group Rugosa or Tetracoralla among the more modern
ous families.

ue significance of the septal arrangement of corals, and often the
rangement itself, can only be determined by full investigations of the soft parts of the polyps at different stages. It was the hope of furthering this, and, if possible, of discovering some indications of relationships from the polyps themselves, that induced workers like Prof. G. von Koch, Dr. G. H. Fowler, and Prof. G. C. Bourne to undertake their elaborate investigations on the morphology of Madreporarian polyps. So far, the results from this standpoint are confessedly disappointing. They have in the main but served to demonstrate the general Hexactinian character of the group. Of late years von Koch, Ortmann, Miss Ogilvie, and others have directed their attention to the microscopic structure of the corallum, and have sought to obtain from this characters of classificatory value.

A residence within the neighbourhood of coral-reefs has afforded me the opportunity of examining, both in the living condition and anatomically, over a score of species of coral polyps, all well known, West Indian shallow water forms. The following notes are a brief résumé of what appear to be the more important results in connection with the order of appearance of the mesenteries and septa.

The first six pairs of mesenteries are found to differ so essentially in their mode of origin and significance from the mesenteries appearing later that I find it convenient to have some word which will include them either as a whole or individually. I therefore propose for them the term "Protocnemes," and shall refer to the mesenteries subsequently developed as "Metacnemes." Similarly with the septa: the six or twelve primary septa, appearing in association with the protocnemes, will be referred to as "Protosepta," and the later formed members as "Metasepta."

DEVELOPMENT OF THE PROTOCNEMES.

From the time of the publication of the classic researches of Prof. H. de Lacaze-Duthiers (1872–73) onwards, numerous embryological studies, upon both the Actiniaria and Madreporaria, have demonstrated that the twelve primary mesenteries always arise in bilateral pairs in a definite order.

In the larvae of *Actinia mesembryantheum*, *Bunodes gemmacea*, etc., Lacaze-Duthiers found that the first pair of mesenteries divided the coelenteric cavity into two unequal compartments. The second pair appeared in the larger or dorsal of the two chambers, cutting off a middle chamber; then within the primary smaller or ventral chamber the third pair was developed. The fourth pair is described as appearing between the first and second pairs, but most subsequent researches have demonstrated that it arises at the dorsal extremity, its members becoming the sulcular directives. The fifth and sixth pairs arise practically simultaneously, and, as now proved for a number of forms, within the middle and sulco-lateral chambers on each side. The relative positions of the second and fourth pairs of mesenteries, as understood by Lacaze-Duthiers, are represented on the annexed figure by the Arabic numerals, while the Roman numerals show the order since established (Fig. 1). In his last important contribution on corals Prof. Lacaze-Duthiers (1897) indicates that in *Balanophyllia regia* the fourth pair of mesenteries is situated between the first and third pairs, that is, it corresponds with the sixth pair of Fig. 1.

The order of appearance of the primary mesenteries in such that each new pair arises within the succeeding oldest and largest chamber, which thereby becomes divided into two compartments on each side.

Two of the most complete series of stages in the development of the protocnemes of Madreporarian polyps are now known, as a result of the researches of Prof. H. V. Wilson and Prof. G. von Koch. H. V. Wilson (1888) has traced their origin in the West-Indian coral, *Manicina areolata*, from the earliest stage in the larva to the young polyp with three cycles of mesenteries. The second and fourth pairs of protocnemic mesenteries being transposed, Wilson's results agree with those of Lacaze-Duthiers. G. von Koch (1897) describes and figures the order of development in the young polyp of *Caryophyllia cyathus*, from the stage with four mesenteries to the completion of the first cycle. In this species the sequence is in perfect agreement with that obtained by Wilson.

My own results upon the larvae of *Manicina areolata* confirm those of Wilson. Stages with from three to six pairs of mesenteries have been obtained, the last (Fig. 1) also reproducing most of the details of von Koch's figure (p. 670) of Caryophyllia. The young polyps of Manicina remained for a week or two at the protocnemic stage, the first cycle of septa arising in the meantime. Evidence confirmatory of the same order of sequence has also been obtained from the larvae of *Favia ananas* and *Cladocora arbuscula*; stages with from three to six pairs of mesenteries have been secured. Non-extruded larvae of *Porites clavaria* also reveal a phase with only three pairs of mesenteries, and the adult polyps complete the stage shown in Fig. 1.

The examination of a number of early stages in the budding of polyps discloses that in the asexual method of increase there is the closest agreement in the order of development of the mesenteries with that above described for the sexually-produced polyps. The youngest bud obtained is from a colony of *Cladocora arbuscula*; only eight protocnemes are present, all united with the stomodaeum. Shortly below the stomodaeum only four mesenteries remain, and bear mesenterial filaments; then two of these disappear; and the two remaining, representing the first pair to arise, are continued much further, and bear filaments almost to their termination. In other buds of Cladocora sectionized all the protocnemes are already developed; the Edwardsian mesenteries are complete, and the fifth and sixth pairs incomplete, just as in the larva of Manicina (Fig. I).

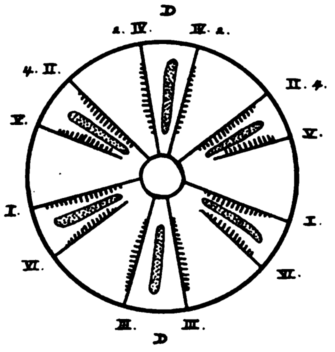

FIG. 1.

Diagrammatic arrangement of the mesenteries of a young polyp of *Manicina areolata* at the stage with six entocoelic septa. Only six pairs of Protocnemes are present, the Edwardsian mesenteries complete, and the fifth and sixth bilateral pairs incomplete. The Roman numerals indicate the order in which the pairs of mesenteries have been found to appear, while as regards the second and fourth pairs the Arabic numerals give the order as understood by Prof. Lacaze-Duthiers. Mesenteries VI. and I., and V. and II. on each side of the polyp constitute 'unilateral' pairs, in contradistinction to the 'bilateral' pairs in which the moietes are on the opposite sides. The same stage of mesenterial development occurs in most of the mature polyps of Madrepora and Porites, and is a resting stage in the development of many coral and Actinian larvae and of asexually produced coral buds. The lower aspect is ventral or sulcar, the upper dorsal or sulcular. D, D, Directives.

Similarly with buds of Solenastraea: stages have been obtained in which only four pairs of mesenteries are complete and bear mesenterial filaments, while the two incomplete pairs are devoid of filaments and disappear in advance of the others. In a very early bud of Madrepora sectionized all the protocnemes are already present, but their relative size and extent of course are such as to suggest that the pairs appeared in the order established for the mesenteries of sexually originating polyps.

The polyps of the three types of West-Indian Madrepora (*palmata*, *prolifera*, *cervicornis*), as also those of three different species of Porites examined, rarely develop beyond the protocnemic stage. The four pairs of Edwardsian mesenteries are nearly always complete, and the fifth and sixth pairs are incomplete throughout the extent of the stomodaeum, and devoid of mesenterial filaments. The adult polyps of Madrepora and Porites then are essentially larval as regards the extent of development of the mesenteries, and in the fuller account it will be shown that the tentacles are in a similar phase.

Summarizing we find:

(1). That the twelve protocnemes arise within the larva in bilateral pairs in a definite order, which is probably the same throughout the Madreporaria and Actiniaria.

(2). Two pairs of directives are always present.

(3). The first four pairs are the earliest to unite with the stomodaeum (Edwardsia-stage), and a long interval may elapse before the fifth and sixth pairs become complete, and the metacnemes appear.

(4). The development of the protocnemes in asexually-produced buds is in close agreement with that of sexually-produced polyps.

(5). Most of the polyps of the genera Madrepora and Porites never pass beyond the protocnemic stage.

ORDER OF DEVELOPMENT OF THE METACNEMES.

While much attention has been given to the order of appearance of the protocnemes in the Madreporaria and Actiniaria, comparatively few observations have been recorded with regard to the sequence of development of the metacnemes. For the Madreporaria the establishment of this becomes a matter of great importance, seeing that by it is determined the septal arrangement of the adult coral.

The passage from the protocnemic to the metacnemic stage of Actinozoan development is one of the greatest morphological significance. Prof. Lacaze-Duthiers was the first to realize this in the Actiniae. Thus, in his résumé of the development of *Actinia mesembryanthemum*, etc., (p. 362) he writes: "Ainsi la loi qui préside à la multiplication des parties depuis l'origine jusqu'au nombre douze, n'est pas la même que celle qui régit la multiplication après que ce chiffre est atteint."

As regards sexually-produced coral polyps we have no records of the actual order of appearance followed by the metacnemes. The embryological observations of Lacaze-Duthiers, von Koch, and Wilson, so far as they concern the polyps themselves, practically cease with the protocnemic stage. From a study of young buds I have, however, obtained a number of such developmental stages, and there is little doubt that the sequence in these is exactly the same as that in polyps with direct larval predecessors. Buds and young polyps of *Cladocora arbuscula* will serve as examples up to a certain stage.

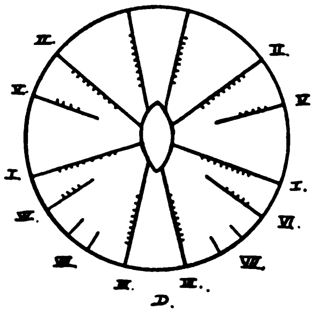

FIG. 2.

Plan of mesenterial arrangement in a young bud of *Cladocora arbuscula*. The protocnemes are at the same stage of development as in Fig. 1, but two pairs of metacnemes (VII., VII.) have appeared within the ventral exocoeles.

Fig. 2 represents diagrammatically a transverse section through a bud in which two pairs of mesenteries are present, in addition to the twelve protocnemes; of the latter, only the Edwardsian mesenteries are complete, and bear mesenterial filaments below. The two pairs of metacnemes occur in the exocoeles, one on each side of the sulcar or ventral directives, and as yet are very rudimentary, extending but a short distance down the column-wall. No muscular elements nor mesenterial filaments are distinguishable.

A transverse section through a somewhat older bud of Cladocora is represented in Fig. 3. Even yet the fifth and sixth bilateral pairs of protocnemes are free towards the lower termination of the stomodaeum. Six alternating pairs of metacnemes are now present, but show a marked gradation, in the extent of their development, in passing from the ventral to the dorsal aspect of the polyp. Mesenterial filaments occur on the pairs in the ventral exocoeles, and the longitudinal muscle fibres are recognizable; muscle fibres are also present on the pairs in the middle lateral

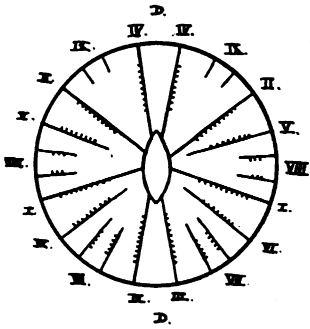

FIG. 3.

Plan of mesenterial arrangement in an older bud of Cladocora. Six pairs of metacnemes (VII.-IX.) have appeared, and show a progressive development from the ventral to the dorsal aspect.

:les, but no trace of mesenterial filaments; the pairs in the dorsal :les are very rudimentary. The proportional development indicates, s also the previous figure, that the sequence of appearance of the nemes is from the ventral to the dorsal border of the polyp, which ;ard to the colony as a whole is from the abaxial to the axial . At a little later stage the mesenteries are arranged as follows: protocnemic pairs, all the members complete and forming unilateral except the directives, which remain bilateral pairs; (2) six alter- metacnemic pairs, all incomplete, equally developed, and bearing nts. Many polyps in a colony are not developed beyond this stage.

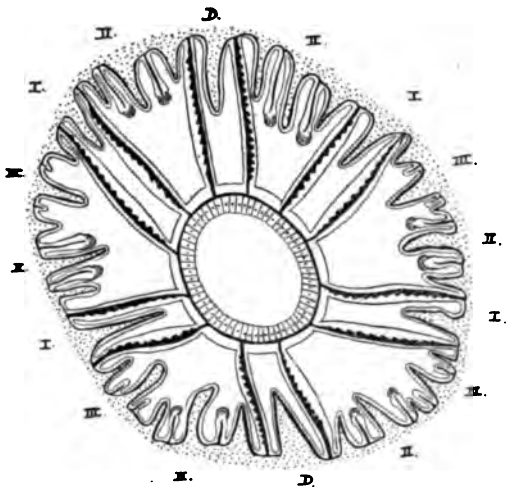

FIG. 4.

verse section through a polyp of Cladocora with sixteen pairs of mesenteries and nding entocoelic and exocoelic septal invaginations. The four pairs of second- etacnemes (III., III.) are very small, and occur on the dorsal aspect of the ventral ldle first-cycle metacnemes.

may now consider the order of appearance of the second-cycle nemes. These, when complete, consist of twelve pairs disposed the twelve exocoeles of the first-cycle metacnemes and the protoc·

Mature polyps of Cladocora usually possess a certain number of -cycle metacnemes, but never the full complement. Fig. 4 represents verse section through the stomodaeal region of a polyp with sixteen f mesenteries. Of these the six complete pairs are protocnemes, the ternating pairs are first-cycle metacnemes, and the four pairs ning are the only representatives of the second-cycle metacnemes. tter are but feebly developed and devoid of mesenterial filaments.

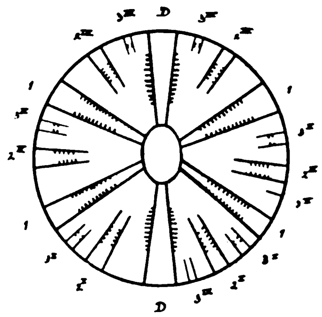

FIG. 5.

f mesenterial arrangement in a young polyp of *Manicina areolata*. Six pairs of :ycle metacnemes (3I.–3III.) have appeared in the dorsal exocoele of each primary and the six remaining pairs are now beginning to arise in the ventral exocoele primary system (3IV., 3V.).

ct of greatest importance in connection with the new pairs of metac- is their restriction to the exocoeles on the dorsal aspect of the first- netacnemes, not to both the dorsal and ventral aspects as consider- of symmetry would suggest. The latter consideration is evidently me by spatial necessities.

The polyps of *Cladocora arbuscula* very rarely pass beyond the stage with sixteen mesenteries, which corresponds externally with thirty-two tentacles. For the further mesenterial sequence, therefore, other species will be employed. Fig. 5 is a diagrammatic representation of the mesenteries in a young polyp of *Manicina areolata*, as they appear in sections towards the lower termination of the stomodaeum. Six complete pairs of protocnemes are present, six well developed, incomplete pairs of first-cycle metacnemes, and six small pairs of second-cycle metacnemes. The last series are disposed in the same relative positions as in Cladocora. The lower portion of the figure reveals how the remaining six pairs of second-cycle metacnemes, necessary to complete the cycle, arise. One pair is seen on the right side, within the exocoele between the ventral pair of directives and the pair of first-cycle metacnemes. In the corresponding middle exocoele a single mesentery has also appeared, but none as yet on the left side.

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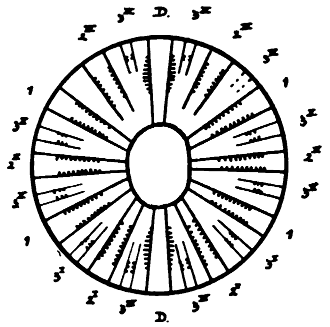

FIG. 6.

Plan of mesenterial arrangement in a polyp of *Phyllangia americana*. Ten pairs of mesenteries (six protocnemes and four first-cycle metacnemes) are united with the stomodaeum. The full complement of twelve pairs of second-cycle metacnemes is now present, except the two pairs in the ventral exocoeles of the two dorsal primary systems.

Polyps of *Phyllangia americana* afford some interesting stages beyond that represented by Manicina. In Fig. 6 four pairs of second-cycle metacnemes have become united with the stomodaeum, in addition to the protocnemes, but the dorsal pair on each side is yet incomplete. Ten pairs of second-cycle metacnemes are present, but the exocoele between the dorso-lateral pair of protocnemes and the most dorsal pair of first-cycle metacnemes is still unoccupied. On the right side, however, such a pair (3VI) is seen making its appearance in the sections somewhat higher.

Fig. 7 represents a slightly further stage of mesenterial development in the same species. Twelve pairs of mesenteries are now united with the stomodaeum; six pairs are the protocnemes, and the other six alternating with these are the first-cycle metacnemes. The full complement of twelve pairs of second-cycle metacnemes is also represented, and, at the lower aspect, a few pairs of third-cycle metacnemes have made their appearance. None of the species at my command goes beyond the stage represented by Phyllangia.

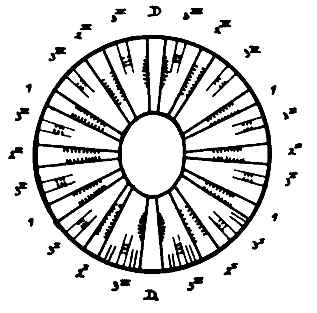

FIG. 7.

Mesenterial arrangement in another polyp of *Phyllangia americana*. The twelve pairs of second-cycle metacnemes are now completed and representatives of the third-cycle metacnemes are appearing at the ventral aspect.

Mesenterial sequences similar to the above have been obtained from buds and polyps of other corals, such as species of Solenastraea, Siderastraea, Orbicella, and Astrangia. There can be no doubt that the order thus briefly outlined is, in the main, that followed by corals in which the mesenteries are disposed in regular hexameral cycles. Certain exceptions have been met with, which must be regarded as characteristic of individual species; and irregularities at times creep in, especially in the later cycles. Thus in *Solenastraea excelsa* the metacnemes may arise first on the sulcular aspect of the polyp; in one young bud the two first pairs appeared in the middle exocoelic chamber on each side; further, the succession follows quite a different plan after the completion of the first cycle of metacnemes.

In all the genera mentioned asexual reproduction is by columnar budding, but in Manicina, Maeandrina, Colpophyllia, Isophyllia, Dichocoenia, etc., discal fission prevails. A successive series of preparations of *Manicina areolata* has been secured, as far as the stage with four oral apertures, so that the effect of discal fission upon the mesenterial arrangement can be traced. It is found that the cyclical plan, with two pairs of directives, prevails in the young, sexually-produced polyps, but tends to disappear after the first two or three stomodaeal systems have been established by fissiparity. In the most characteristic genera increasing by this means, only one or two orders of magnitude are represented by the mesenteries. Further, two pairs of directives are never found in polyps produced by fissiparity, while such appear to be always present in polyps arising by budding.

With regard to the metacnemes the results may be stated as follows:

(1). In most coral polyps the addition of mesenteries beyond the primary six pairs takes place in successive unilateral pairs; the corresponding pairs on each side are mostly simultaneous in their appearance, and are always exocoelic in position.

(2). The first cycle of metacnemes, consisting of six pairs, arises in successive pairs from one aspect of the polyp (sulcar or ventral) to the other (sulcular or dorsal), the pairs afterwards becoming equal. They usually remain free from the stomodaeum, but in large polyps may become connected in successive order.

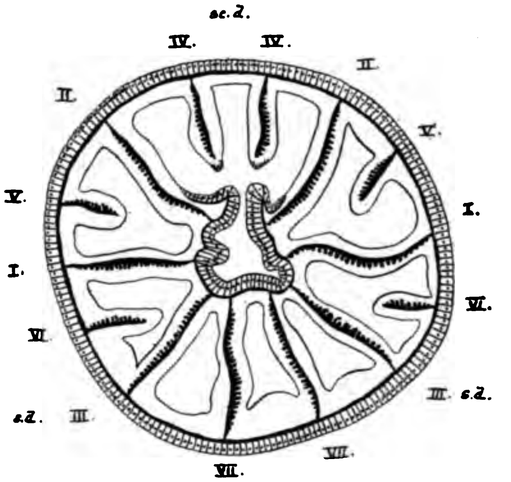

FIG. 8.

Transverse section through the lower stomodaeal region of a polyp of *Porites clavaria*. The stomodaeum is already terminated on the dorsal aspect, the sulcular directives (*sc. d.*) having become free. In addition to the six pairs of protocnemes (I.–VI.) another pair of mesenteries (VII.) has appeared within the entocoele of the ventral or sulcar pair of directives (*s. d.*, *s. d.*).

(3). The second-cycle metacnemes consist of twelve pairs; six pairs arise in succession from one aspect of the polyp to the other, and all on the same aspect of the first-cycle metacnemes; the remaining six pairs appear in the same succession, but on the reverse aspect of the first-cycle metacnemes.

(4). In any species the adult polyps may or may not possess the full number of pairs necessary for the completion of the last cycle commenced.

(5). Polyps originating by discal fission lose, for the most part, the cyclical regularity characteristic of the sexually-produced polyps, and of polyps originating by columnar gemmation; directive mesenteries are also absent, though they always occur in the latter.

INCREASE OF MESENTERIES IN PORITES.

As already mentioned, the tentacles and mesenteries in the genus Porites are nearly always twelve in number, and larval in the extent of their development. Very exceptionally polyps are met with in which these organs may be increased to fourteen, sixteen, or even to twenty-four; similar increases are likewise found here and there in the septa of individual corallites. An examination of transverse sections of the larger polyps reveals that the increase in the number of mesenteries takes place in a manner different from any yet described in the Madreporaria. In Fig. 8 is represented a transverse section through the lower stomodaeal region of a polyp in which fourteen mesenteries are present, that is, two beyond the usual number. The primary mesenteries retain their original condition,—four pairs complete and two pairs incomplete. Within the sulcar or ventral entocoele, however, another complete pair (VII.) has been added, and the sulcar directives are pushed further apart. The retractor muscles on this newly added pair are on the faces of the mesenteries turned towards each other, so that each forms with the adjacent directive mesentery a unilateral pair, in which the retractor muscles are on the mesenterial faces turned away from one another, as in directives proper.

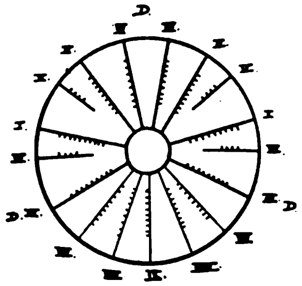

FIG. 9.

Plan of mesenterial arrangement in another polyp of Porites. Five complete mesenteries (VII.–IX.) now occur within the entocoele of the ventral directives (III., III.).

The next stage obtained is one in which fifteen mesenteries occur; fourteen are in the same condition as in the previous figure, and the additional member appears within the entocoele of the seventh pair. Fig. 9, from a polyp with seventeen mesenteries, shows how the increase is being carried out. Within the entocoele of the seventh pair another complete pair (VIII., VIII.) has been added. The longitudinal muscles are on the faces turned away from one another, so that now the members of the metacnemic pairs (VII., VIII.) on each side of the polyp form a unilateral pair, in which the musculature is on the faces turned towards each other. The odd mesentery (IX.) is again situated in the entocoele of the last formed pair.

In Fig. 10 is given the mesenterial arrangement of a polyp with ten pairs of mesenteries, as presented just below the stomodaeal region. The twelve dorsal mesenteries, represented by thicker lines, are the protocnemes, and the eight ventral mesenteries, indicated by thinner lines, are the metacnemes. The paired arrangement is constituted as follows: The pair, IV., IV. are the dorsal directives, and form a bilateral pair; II. and V., on each side, represent a pair of which one mesentery is larger than the other; similarly with I. and VI., on each side. Mesenteries III., III. are the ventral directives, and are now widely apart; each forms with VII. a mesenterial pair on each side, in which the musculature is on the faces turned away from one another, as in directives. Mesenteries VIII. and IX., on each

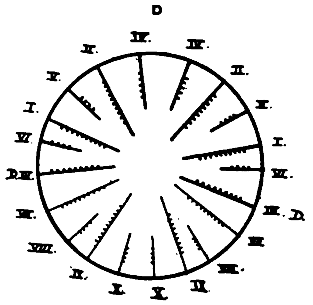

FIG. 10.

Plan of mesenterial arrangement a little below the stomodaeal region of a polyp of Porites with eight additional mesenteries. The pairs are now constituted of a larger and a shorter mesentery, except in the case of the dorsal directives where both mesenteries are small, and of the pair III. and VII. on each side. Here both members are large and bear the longitudinal musculature on the faces turned away from one another.

side, form an unequal pair, in which the larger mesentery is on the ventral aspect, the reverse of that in pairs II., V., and I., VI. The pair X., X., is the last to appear, and is brachycnemic, with the musculature on the faces turned towards one another.

The next figure presents another arrangement. The new mesenteries are added at the sulcular or dorsal region of the polyp, not as in all the former, at the sulcar or ventral end. The six primary pairs still retain their original condition, but the sulcular directives (IV., IV.) are now widely separate, and enclose within their entocoeles three additional bilateral pairs of mesenteries. As in the previous case, the bilateral mesenteries, VIII. and IX., form two unilateral pairs, and each of the sulcular directives, along with the members of the seventh pair, also constitute two unilateral pairs, but with the musculature on opposite faces. The furthest stage obtained is one in which twenty-three mesenteries occur. Here also the new members arise within the sulcular entocoele. The bilateral pairs, VIII. and IX., and X. and XI., constitute four unilateral pairs.

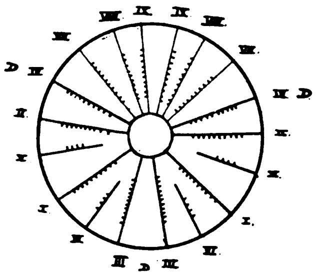

FIG. 11.

Mesenterial arrangement in a polyp of Porites in which three additional bilateral pairs of mesenteries (VII.–IX.) occur within the entocoele of the *dorsal* directives (D. IV.).

The new mesenteries are arranged throughout at practically equal distances apart, and extend downwards in the polyps to the same extent as most of the complete members of the primary series, and, like them, bear mesenterial filaments. All may be complete, but there is obviously a tendency to the formation of alternately large and small bilateral pairs, especially below the stomodaeal region, and the fifth and sixth protocnemic pairs remain incomplete.

The results may be thus summarized:

(1). In Porites the additions of mesenteries beyond the six primary pairs are always made at either the sulcar or sulcular region of the polyps, and within an axial entocoele.

(2). The new members arise in bilateral complete pairs, the latest formed appearing within the entocoele of the previously formed pair.

(3). The longitudinal muscles on the mesenteries are so arranged that the members of the first additional pair constitute, with the sulcar or sulcular directives, as the case may be, two unilateral pairs, in which the musculature is on the faces turned away from one another. In the succeeding pairs the musculature is alternately on the inner and outer faces, so that the eighth and ninth bilateral pairs on each side form a unilateral pair in which the muscular faces are turned towards each other, and likewise the tenth and eleventh pairs.

(4). Below the stomodaeum the unilateral pairs consist of alternately longer and shorter mesenteries, the order varying according as the additions are sulcar or sulcular in position.

The great distinction thus established between the manner of appearance of the metacnemes in Porites, and that in all other known coral polyps, is seen to be that, in the former, additions takes place in bilateral pairs at only one region, and within an entocoele, whereas, in the latter, the additions are made all round the polyp in unilateral pairs, and within exocoelic chambers; in the former the mesenteries remain unicyclic, in the latter they become multicyclic. In Porites the unilateral pairs below the stomodaeum consist of a brachycnemic and a macrocnemic moiety, while in other Madreporaria the members of a pair are alike in size throughout, and agree with the others belonging to the same cycle.

The three principal divisions of the Actiniaria—Hexactiniae, Zoantheae, Ceriantheae—are also characterized by a difference in the origin of the metacnemes. In the Hexactiniae they appear in unilateral pairs within the exocoeles of the primary cycle, and ultimately give rise to alternating cycles, as in most Madreporaria. On account of this similarity of the mesenterial arrangement the Madreporaria have been considered by writers such as Prof. R. Hertwig and Prof. McMurrich as probably belonging to the Hexactiniae, the main difference being the presence of a skeleton in the one and its absence in the other. Further minor differences can now be established, such as the presence in most Hexactiniae of gonidial grooves in the stomodaeum, and ciliated streaks (Flimmerstreifen) to the mesenterial filaments, and their invariable absence in the Madreporaria.

The mesenterial arrangement in the Zoantheae approaches somewhat that in Porites. Beyond the protocnemes the new mesenteries arise in only two regions, one on each side of the ventral directives. Further, the unilateral pairs consist of a macrocnemic and a brachycnemic moiety, as in Porites, though in the Zoantheae the brachycnemic members at no time reach the stomodaeum.

Of all Actiniaria the Ceriantheae most nearly approach the condition in Porites. For here the mesenteries beyond the four Edwardsian pairs (?) arise as bilateral pairs at the dorsal region of the polyp, each within the entocoele of the previously-formed pair. The bilateral pairs are all complete, and apparently no incomplete protocnemes are ever developed. The Ceriantheae, therefore, bear much the same relation to the Hexactiniae which Porites does to the rest of the Madreporaria; and in any classification of the latter, based upon the morphology of the polyps, Porites should receive recognition equal to that accorded Cerianthus among the Actiniaria.

THE PROTOSEPTA.

Prof. Lacaze-Duthiers (1873) was the first to observe the origin of the primary septa in coral larvae, his researches being conducted upon *Astroides calycularis*. Twelve independent septa were found to appear simultaneously, one in each mesenterial chamber, while the larvae was at the protocnemic stage of development. Prof. G. von Koch (1882) subsequently obtained similar results for this species, at the same time fully establishing the ectodermal origin of the skeleton. Von Koch's (1897) recent paper on the development of *Caryophyllia cyathus* indicates that in this coral the six entocoelic septa alone are the first to appear, the alternating exocoelic septa arising later. Here again the protocnemes alone are developed, the fifth and sixth pairs being incomplete. Prof. Lacaze-Duthiers (1897) in his latest work on corals, has made other contributions to our knowledge of the early stages in the development of the septa. A very complete series, illustrating the appearance of the septa in *Balanophyllia regia*, as well as notes on Caryophyllia and other species, are given. The corals Leptopsammia, Cladopsammia, in addition to Astroides and Balanophyllia, are stated to possess twelve primary septa.

My observations on the young polyps of *Manicina areolata* correspond somewhat with those of Lacaze-Duthiers and von Koch. The first six septa appeared simultaneously within the entocoeles of the larva, at the stage with twelve mesenteries (Fig. 1). No indications were afforded of any exocoelic septa, although a considerable interval elapsed between the appearance of the septa and the preservation of the young polyps. Studies of later stages in the development of the young polyps and of the adult colonies demonstrate, however, that at no stage do exocoelic septa appear in Manicina.

The simultaneous appearance of the six or twelve protosepta in larvae or young polyps, is thus in marked contrast with the successive order of development of the pairs of protocnemes. The septa only appear when these latter have attained the Edwardsia stage, with the fifth and sixth pairs incomplete. Likewise in polyps arising by gemmation, as I have found in Madrepora, the six pairs of protocnemes are established before any corresponding septa make their appearance; so that it seems likely the protosepta arise simultaneously also in asexually produced polyps.

THE METASEPTA.

An interval of several weeks in the life of the young polyp may elapse between the completion of the protocnemes and protosepta and the appearance of the metacnemes and metasepta. Neither in the works of Prof. Lacaze-Duthiers nor of von Koch are the metasepta traced as regards their association with the mesenteries. For what follows, therefore, we shall be dependent upon results obtained from asexually-produced buds; but there seems no reason for supposing that the order is here different from that in sexually-produced polyps.

First, it may be stated that the metasepta are found to appear in pairs, practically simultaneously with each pair of metacnemes, not, like the protosepta, a cycle at a time. Therefore the actual order of succession already determined for the mesenteries is that followed by the septa, and need not be again repeated. It is indicated in Fig. 12. Good preparations showing the early metasepta in association with the first-cycle metacnemes, are difficult to obtain, and the stages are rarely regular on both sides of the polyp. From both *Cladocora arbuscula* and *Solenastraea excelsa* various series of preparations of young polyps have been secured, which prove conclusively that with each pair of metacnemes there is early associated two additional septa—one within the entocoele of the mesenteries and one within the exocoele on the dorsal or ventral aspect, as the case may be. The entoseptum may appear slightly in advance of the exoseptum, and soon exceeds the latter in size. In Fig. 4 both entocoelic and exocoelic septa are already present along with the four pairs of second-cycle metacnemes, although the latter are very small. Each entoseptum has its corresponding exoseptum, and it is obvious that the two last cycles of septa are both incomplete numerically.

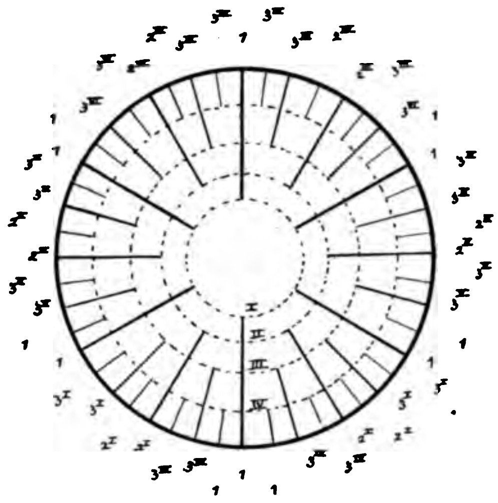

FIG. 12.

Diagram to illustrate the order of appearance of the septa in a coral polyp with four complete cycles of septa, based on the supposition that an entocoelic and an exocoelic septum arise with each new pair of mesenteries. In relation to the mesenteries the three inner cycles are entocoelic and the last is exocoelic. The first cycle of six entosepta (1–1) appear simultaneously, and also the corresponding six exosepta, now in the last cycle. The members of the second cycle of six entosepta (2I, 2II, 2III) appear successively from one aspect of the polyp to the other, along with the corresponding exosepta in the last cycle. The members of the third cycle of twelve entosepta (3I.–3VI.) appear successively from one aspect of the polyp to other, but the pairs 3I, 3II, 3III on the dorsal aspect of the second-cycle septa are completed before pairs 3IV, 3V, 3VI arise on the ventral aspect of the second-cycle septa. The last cycle of twenty-four exocoelic septa is constituted of members which have appeared in association with the previous septa in the order indicated in the outer cycle of numerals. The corresponding septa on opposite sides arise practically together and are so indicated.

In nearly all corals with several hexamerous cycles of septa it is found that the first cycle of six occurs within the entocoeles of the six pairs of protocnemes, the second cycle within the entocoeles of the six pairs of first-cycle metacnemes, the twelve septa of the third cycle within the twelve pairs of second-cycle metacnemes, and so on; but the septa of the last cycle are exocoelic. In the fissiparous genera Manicina, Maeandrina, Isophyllia, and Favia exosepta are generally wanting; only entosepta are present.

It has already been shown that where in the young polyp two cycles of protosepta occur, the six forming the first cycle are entocoelic, and the six forming the second cycle are exocoelic; whereas in all older polyps the second cycle of septa is entocoelic, and only the last is exocoelic. An important question in Madreporarian morphology therefore arises, namely, what is the relation of the newly added mesenteries to the already existing exocoelic protosepta? Does each new pair of mesenteries grow downwards from the column-wall so as to include an exoseptum within its entocoelic chamber, and then two new exosepta arise on each side; or does the new pair of mesenteries come to be situated on one side of an exoseptum, that is, in the chamber between an exoseptum and an entoseptum, and a new entocoelic and exocoelic septum arise in association therewith? I have as yet been unable to obtain decisive evidence in proof of either view. Many facts seem to point to the latter method as being the one actually followed, in which case it will be necessary to take an altogether different conception of the relations of coral septa from that usually accepted. With whatever cycle of mesenteries the exosepta are primarily formed they will all be relegated in the mature polyp to the last cycle, and all the previous cycles of septa will be entoseptal from the beginning. The septal cycles will then correspond in order of appearance with the cycles of mesenteries with which they are associated. On this view the order of appearance of the septa for a polyp with four cycles—three entocoelic and one exocoelic—will be as represented in the annexed diagram (Fig. 12).

This is actually the relationship which Prof. Lacaze-Duthiers, and later Dr. L. Faurot (1895), have established for the tentacles of the Actiniaria, and I find it to be the same for the tentacles of the Madreporaria. As is now well known the Actinian tentacles beyond the primary twelve appear two together, along with each new pair of mesenteries. Of the two tentacles one is entocoelic and the other exocoelic in relation to the new mesenteries. The former becomes the larger and takes its place in the tentacular cycle corresponding with the mesenterial cycle with which it is associated; the latter, the exocoelic tentacle, is relegated, as it were, to the last cycle of tentacles, and becomes uniform in size with the other exocoelic tentacles.

The problem of the septal sequence may be restated as follows: Do the septa beyond the primary series arise as exocoelic pairs, or, like the tentacles, is each new pair constituted of an entocoelic and an exocoelic member?

The view emphasized by Milne-Edwards and Haime in their classic "Coralliaires," and practically followed by all subsequent students of corals, is that the magnitude of the septal cycles in general corresponds with their age, the smallest cycle being the youngest. Accepting this we shall have to believe that as new mesenteries are added the pairs embrace the exosepta of the previous cycle, and then two new exosepta arise, one on each side of the new mesenteries; the new mesenteries of the next cycle in their turn would enclose the exosepta within their entocoeles, other exosepta would then be formed, and so on. In other words, the exosepta of one cycle of mesenteries become the entosepta of the next cycle of mesenteries.

Probably only a study in the larva or young polyps of the actual formation of the metacnemes and metasepta in their relation to the protosepta will determine which of these courses is followed.

METASEPTA IN PORITES.

The metacnemes in Porites have been described as arising in bilateral pairs, at one or the other aspect of the polyp. In all cases the metasepta are found to follow in close succession, an entocoelic and an exocoelic representative on each side. In such small corallites as are characteristic of the genus under consideration, the septa are not favourable for study; but there does not appear to be much difference in size among them. However, from their manner of development there can at most be only two orders represented—entocoelic and exocoelic. A multicylic hexamerous condition, such as is characteristic of most other recent corals, would be impossible.

The bilateral symmetry of the septa, the alternation of only large and small members, and their growth from one or more special regions, are all characters of primary importance among many of the extinct Palaeozoic corals, and, sometimes with a tetrameral arrangement, serve to sharply distinguish these from modern cyclical corals. There can be no doubt that in Porites we have a living example in which the metacnemes and metasepta arise in the same manner as in many of these old time corals.

Even where in fossil or recent corals the adult arrangement of the septa is tetrameral or octameral, examination by means of sections sometimes reveals a primary hexameral condition. All evidence goes to show that the protoseptal phase has always been hexameral in the Zoantharia, and that it is only with the appearance of the metasepta that the distinctive characteristics—cyclical (tetrameral, hexameral, etc.) or bilateral—truly commence. The arrangement of the mesenteries and septa on the cyclical or bilateral plan should, in my opinion, constitute the basis for a primary subdivision among the great group of corals.

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The Arterial Circulation of Nautilus Pompilius.

By LAWRENCE EDMONDS GRIFFIN.

The figures of the arterial circulation have been made partly from my own dissections, and partly from the published figures and descriptions of Willey. In some instances I had obtained the same results as Willey before he published his figures, in others I have merely verified his work, and in places I rely entirely upon his figures and descriptions in order that my own descriptions may be as complete as possible. Some facts are, I think, published for the first time.

In both figures of the arterial system the arteries are viewed from the dorsal side. As the vessels represented in Figure 2, lie almost entirely ventral to those of Figure 1, I believe that they are shown with less danger of confusion in separate figures than in a single figure.

The heart is situated immediately back of the mantle fold in the portion of the cœlom known as the pericardium. It is an oblong, muscular organ of quite considerable size, being 2 cm. in width, 1 cm. in length (antero-posterior measurement), and 6 mm. to 8 mm. in thickness. The long axis of the heart is exactly transverse to the long axis of the body. The right side of the heart is slightly longer than the left side, so the symmetry of the heart is not quite perfect.

A branchial vein enters each corner of the heart. The portion of each branchial vein near the heart is capable of considerable distension, and these portions have been called the auricles of the heart. But very frequently one or all these vessels show no increase in diameter near the heart. This fact indicates that the so-called auricles of Nautilus, while physiologically similar, have not the same morphological importance, and should not be considered as organs of the same nature as the auricles of the heart of the Gastropoda and the Lamellibranchiata. In these classes the auricle forms a distinct chamber which even in its development is distinct from both the ventricle and the branchial veins, which the auricles of Nautilus are not. The term auricle is a convenient one anatomically, indicating the portion of the branchial vein inside the pericardium, which is evidently distensile and pulsatile, but it should probably not be used in the same morphological sense as in the other groups mentioned.

Five vessels arise from the dorsal side of the heart, the courses of which will be described presently.

The heart has thick muscular walls, and, in the contracted state consequent upon death, a very small fissure-like cavity. The inner surface of the heart is pitted, and by its appearance reminds one strongly of the inner surface of a mammalian heart, though by no means distinctly trabeculated. I have not been able to find any valves at the openings of the vessels leading into or from the heart, except possibly the dorsal aorta. The openings are, however, tightly closed, and it is possible that at the commencement of systole the walls of the heart contract first around the openings of the branchial veins and thus the regurgitation of blood is prevented.

The largest vessel proceeding from the heart is the dorsal aorta.[1] This arises from the dorsal surface of the heart, on the left side and near the posterior edge (31). The base of the aorta is conical and possesses thick muscular walls, and could probably be properly spoken of as a conus arteriosus. At the end of the muscular portion of the base of the aorta is an elevation of the inner wall which may be a valve. In some specimens this is quite distinct and much like a semilunar valve; in others it is barely noticeable. Possibly the conical base of the aorta should be considered morphologically as a portion of the heart itself.

Along the median part of the posterior edge of the heart, dorsally also, arise three small arteries. They lie in the portion of the pallio-visceral ligament attached to the posterior side of the heart. The artery at the left is the artery of the pyriform sac (36); the middle one is the genital artery (24); while the one on the right is the gonaducal artery (21).

Also from the dorsal side of the heart, but near the anterior edge, arises the fifth artery, the lesser aorta.

Let us now follow the course of the dorsal aorta and its branches, (Fig. 1.) From its origin on the dorsal side of the heart the aorta extends upward and backward and to the left along the posterior side of the hæmocœlic membrane.[1] Turning forward it penetrates the membrane and enters the hæmocœl, in which it lies free, running forward over the liver and the œsophagus. In the posterior portion of the hæmocœl the aorta lies well to the left of the cavity, but as it extends forward it approaches the median line until, near the œsophageal nerve ring, it lies in the median line (43). Immediately back of the nerve ring the aorta divides into a left and a right branch, the innominate arteries, from which lesser branches are given off to the cephalic region and the funnel (9).

Proceeding from the posterior end of the aorta, the first branch leaves it just after the aorta enters the hæmocœl. Coming off from the right side of the aorta, it runs toward the right side of the body, giving off first a branch anteriorly which passes to the posterior portion of the proventriculus, the posterior proventricular artery (33); next, a branch posteriorly which immediately bends forward and passes around the anterior side of the stomach to the cœcum, the cœcal artery (28); finally, the end of the artery passes to the stomach, forming the gastric artery, which breaks up into numerous fine vessels in the walls of the stomach (27).

Five or six millimeters anterior to the origin of this artery a much larger artery leaves the left side of the aorta (34). After a course of about five millimeters this artery divides into two branches, the anterior of which goes to the left shell muscle, (the left posterior columellar artery, 37), while the posterior branch proceeds to the liver (hepatic artery, 32). I have called the branch of the aorta from which both these arteries arise the hepatico-columellar artery.

The hepatic artery goes to the junction of the two left lobes of the liver. It divides here into three branches. The left and middle branches enter the left lobes of the liver in which they break up into the fine lobular branches (30). The right hand branch of the hepatic artery follows the median connecting portion of the liver to the junction of the two right lobes of the liver. Here it divides into a branch for each lobe (25). Along its course it gives off a considerable branch to the median portion of the liver (29).

The left posterior columellar artery runs forward and upward to the dorsal edge of the left shell muscle near its attachment. After giving off a branch to the dorsal portion of the body wall it bends downward along the inner surface of the shell muscle, giving off numerous branches which enter the muscle (38).

The right posterior columellar artery (18) arises from the right side of the aorta about five millimeters anterior to the origin of the hepatico-columellar artery. Since the posterior portion of the aorta is upon the left side of the body cavity the right posterior columellar artery is considerably longer than the corresponding left artery. The course of the right posterior columellar artery is the same, only inverted, as that of the left.

About twenty millimeters anterior to the origin of the last artery the right pallio-nuchal artery arises as a branch of the aorta (16). The left pallio-nuchal artery (39) arises from the aorta four or five millimeters anterior to the right pallio-nuchal. These arteries pass upward and outward to the dorsal side of the body, entering the body wall at the base of the mantle fold where the latter crosses the dorsal edges of the shell muscles. Several branches leave the pallio-nuchal arteries at this point. Some of these pass into the dorsal portion of the mantle lying against the involution of the shell (42). The main portion of each artery is continued in the thin wall of the dorsal nuchal region, supplying especially the crescentic fold upon the posterior face of the hood (13). As it passes along the edge of the shell muscle it appears to send some small branches into the tissues of the muscle. A considerable branch extends into the crus of the funnel (14). From the outer side of the pallio-nuchal artery a branch enters the mantle which becomes continuous with the marginal pallial branch of the anterior pallial artery (15, 40).

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[1] Until otherwise indicated all references will be to Figure 1.

[1] This is the membrane which, stretched transversely across the body, separates the hæmocœl from the cœlom.

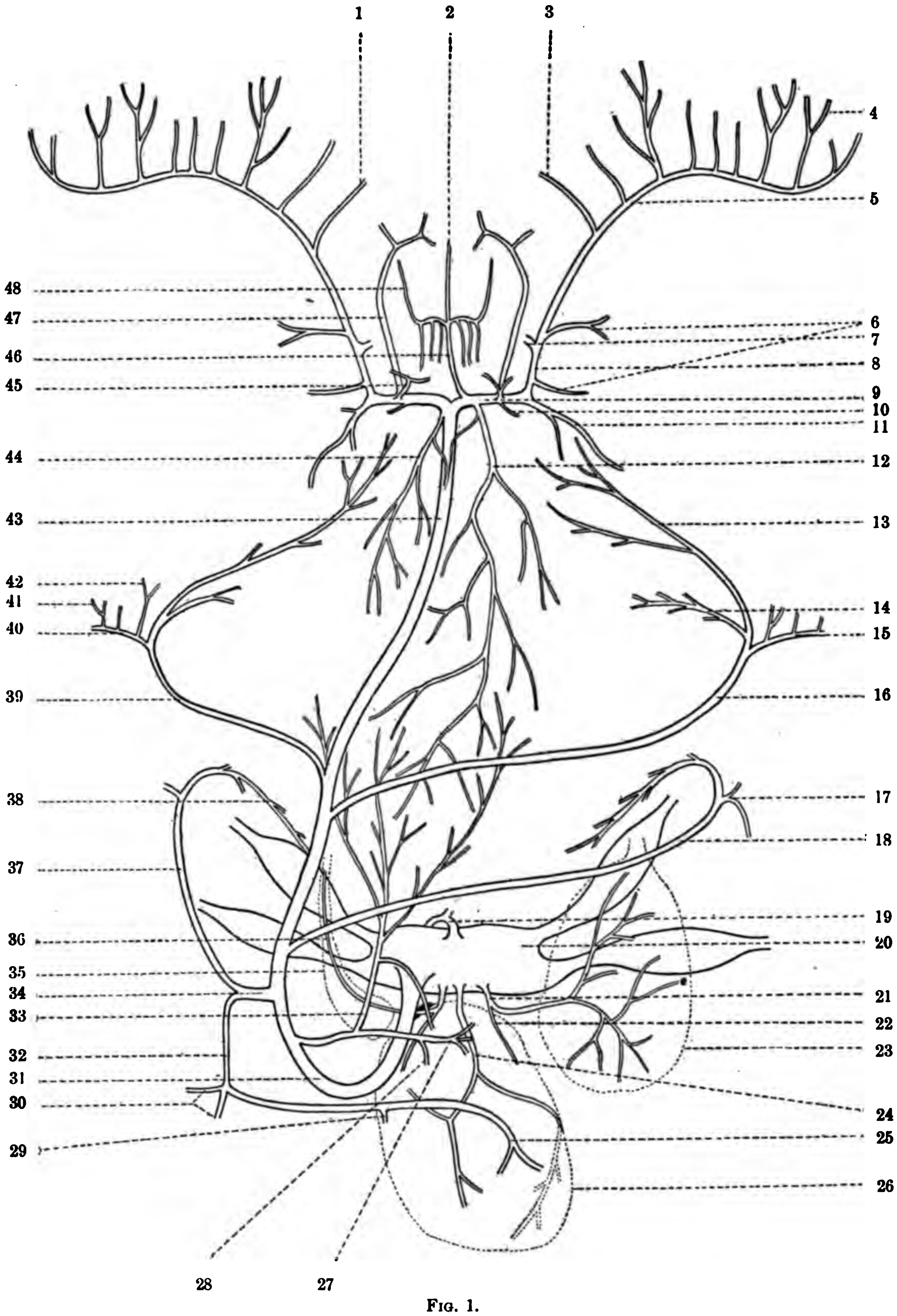

Fig. 1.

1, left artery of Van der Hoeven's organ in the male; of inferior labial lobe in female. 2, superior mandibular artery. 3, right artery of Van der Hoeven's organ in male; of inferior labial lobe in female. 4, artery to individual tentacle. 5, right tentacular artery. 6, arteries of eye. 7, infundibular artery. 8, pedal artery. 9, innominate artery. 10, artery entering posterior part of hood. 11, right anterior columellar artery. 12, right anterior proventricular artery. 13, nuchal artery. 14, crural artery. 15, marginal pallial artery. 16, right pallio-nuchal artery. 17, branch to dorsal body wall. 18, right posterior columellar artery. 19, lesser aorta. 20, heart. 21, gonaducal artery. 22, branch to wall of gonad. 23, outline of genital duct. 24, genital artery. 25, artery of right lobes of liver. 26, outline of gonad. 27, gastric artery. 28, coecal artery. 29, artery to middle portion of liver. 30, arteries to left lobes of liver. 31, dorsal aorta. 32, hepatic artery. 33, posterior proventricular artery. 34, hepatico-columellar artery. 35, outline of pyriform sac. 36, artery of pyriform sac. 37, left posterior columellar artery. 38, descending portion of columellar artery giving off branches to muscle. 39, left pallio-nuchal artery. 40, marginal pallial artery. 41, radial pallial artery. 42, artery to dorsal portion of mantle. 43, dorsal aorta. 44, left anterior proventricular artery. 45, cerebral artery. 46, buccal artery. 47, inferior mandibular artery. 48, labial artery.

Usually no other vessels arise from the aorta until it divides into the innominate arteries.

The anterior proventricular arteries (12, 44), supplying blood to rather more than the anterior half of the proventriculus, frequently arise from the junction of the aorta with the innominate arteries. These arteries are, however, extremely variable in their position, a fact to which Willey has called attention. One or both may arise from the innominates quite to the sides of the aorta, or one may be entirely absent. In Willey's Fig. 23,[1] the left anterior proventricular artery arises from the aorta a considerable distance below its division into the innominate arteries. Two small arterioles going from the anterior proventricular arteries to the walls of the aorta also show considerable variation in their points of origin. Ordinarily one arises from the base of each proventricular artery. In the case figured by Willey both arterioles arise from the right anterior proventricular artery, the left proventricular artery being absent in this case.

The buccal artery (46) usually springs from the right innominate close to its separation from the left. It passes forward upon the dorsal side of the buccal mass, presently dividing into three branches. The median branch, the superior mandibular artery (2), runs straight forward in the median line of the buccal mass, giving off branches to the superior mandibular muscles. The lateral branches first pass outward to the sides of the buccal mass, giving off on the way several small branches posteriorly to the mandibular muscles, then turn forward and pass into the buccal membrane and its papillae (48). The branches of the buccal artery are, however, very variable in the manner of their distribution. Of the origin of the buccal artery Willey says, "It is a singular fact that the great median buccal artery always springs from the right innominate artery. The constancy of this origin would seem to indicate that it is potentially a paired structure." I have dissected specimens in which the buccal artery sprung from the junction of the innominate arteries; in other words, was median. Either position, lateral or median, may be secondary, resulting from a displacement of the base of the artery during growth, and it is difficult to decide which is primitive without the evidence of embryology.

Five or six millimeters from their junction a branch arises from the anterior side of each innominate (the inferior mandibular artery, 47) which runs forward on the under side of the buccal mass to the muscles and organs of the floor of the pharynx. These arteries are closely bound to the buccal nervous system, careful dissection being required to separate the arterial from the nervous elements. The inferior mandibular arteries supply not only the lower parts of the mandibular muscles but also the tongue and the radular sac, the processes anterior to the tongue, and the salivary processes.

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[1] Quart. Journ. of Micr. Sci., Vol. 39.

From the dorsal side of the innominates, near the origins of the inferior mandibular arteries, arise arterioles which pass into the cerebral ganglia (45). From the posterior side of the innominates other small vessels pass into the posterior portion of the hood (10).

Finally, each innominate divides, one branch passing backward into the shell muscles and forming the anterior columellar artery (11), the other branch passing forward and downward along the bases of the tentacles, forming the pedal artery, (8) Willey. Near the base of the pedal artery two arterioles pass outward to the eye (6). Between these a large branch arises from the pedal artery which passes to the funnel, the infundibular artery (7). The remainder of the pedal artery which gives off branches to the individual tentacles Willey has very conveniently named the tentacular artery (5). The first of the branches of the tentacular artery passes into the inferior labial lobe in the female, and into Van der Hoeven's organ in the male (1, 3).

The origin of the genital and gonaducal arteries and the artery of the pyriform sac has already been mentioned.

The genital artery passes from the heart directly back upon the gonad, in which it breaks up into capillary branches (24).

The gonaducal artery passes to the right from the heart and is distributed to the walls of the functional genital duct (21).

The artery of the pyriform sac, or the non-functional genital duct, passes to the left from the heart and extends along this organ (36).

Willey shows that both the gonaducal artery and the artery of the pyriform sac give off a branch which passes into the perigonadial membrane (22), and he says, "this apparently trifling fact, combined with the subsymmetrical relations of the gonaduct and the pear-shaped gland, may indicate that the latter is the metamorphosed genital duct of the left side, and not, as I believe has been suggested, the morphological equivalent of an entire left genital apparatus."

Almost immediately after its origin from the anterior side of the heart the lesser aorta (17) divides into two branches.[1] One, the anterior pallial

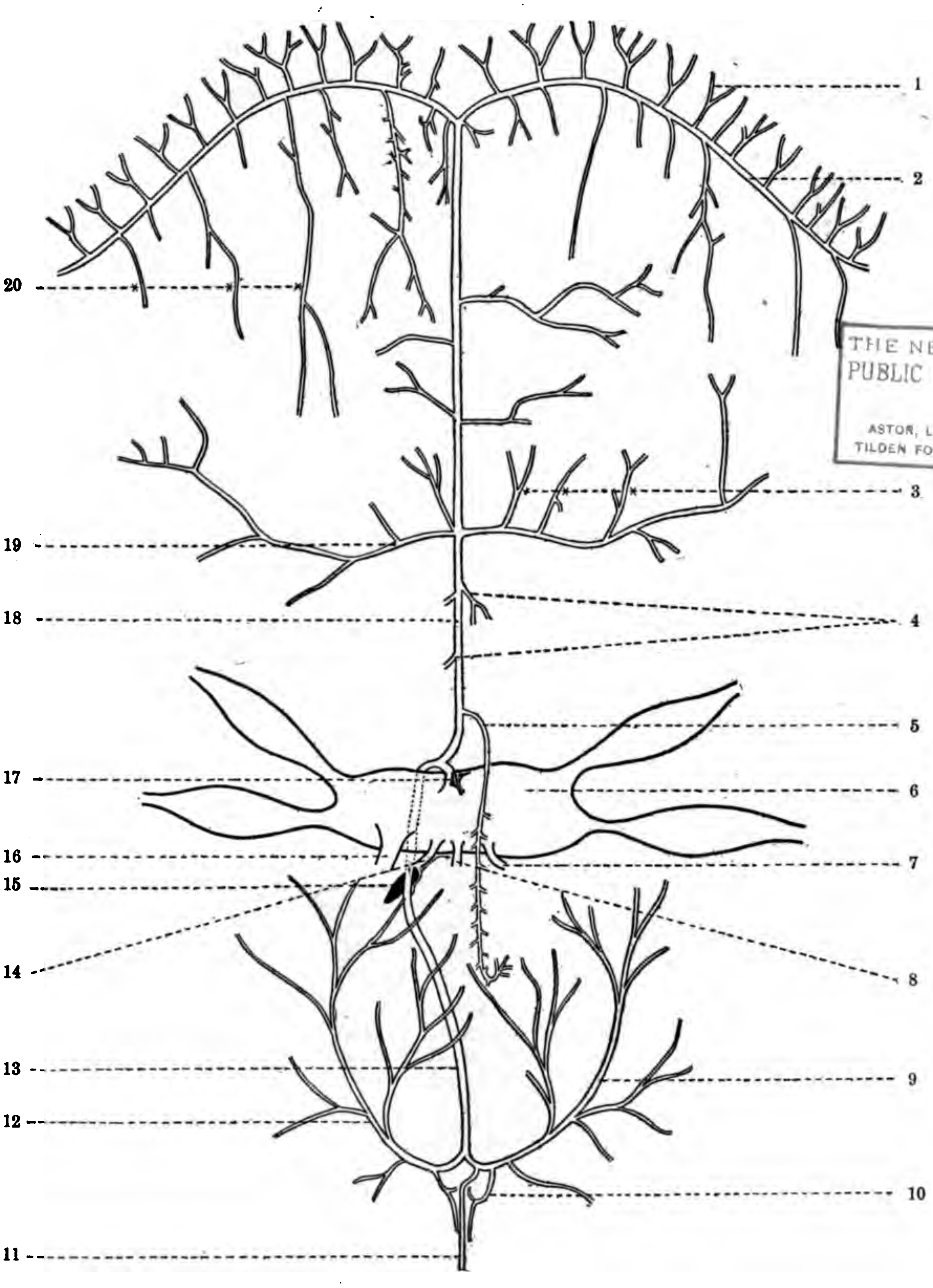

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FIG. 2.

1, radial pallial artery. 2, marginal pallial artery. 3, arteries of nidamental gland. 4, rectal arteries. 5, intestinal artery. 6, heart. 7, gonaducal artery. 8, genital artery. 9, right septal artery. 10, accessory siphuncular artery. 11, siphuncular artery. 12, left septal artery. 13, posterior pallial artery. 14, artery of pyriform sac. 15, posterior viscero-pericardial opening. 16, dorsal aorta. 17, lesser aorta. 18, anterior pallial artery. 19, branchio-osphradial artery. 20, median pallial arteries.

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[1] The arteries described after this are represented in Fig. 2.

artery (18), runs straight forward in the median line of the mantle and is distributed to the intestine, rectum, and mantle. The other, the posterior pallial artery (13),[1] runs almost straight backward and is distributed entirely to the septal portion of the body wall and the siphuncle.

The anterior pallial artery is enclosed by the pallio visceral ligament. A few millimeters anterior to the heart it gives off a slender branch (the intestinal artery, 5) which runs back in the membrane uniting the two portions of the second loop of the intestine. Small arterioles pass from either side into the intestinal tissues.

In front of the intestinal artery several small rectal arteries (4) arise directly from the anterior pallial artery and pass to the walls of the rectum.

At the point where the two walls of the mantle fold unite, and the mantle becomes thin, a pair of vessels arise from the anterior pallial artery and pass outward to the right and the left in the substance of the mantle (19). These arteries, discovered by Willey, were called by him the branchio-osphradial arteries "since among their minor ramifications they send up branches to the tips of the branchiae supplying the integument of the latter, and also a small branch into each of the osphradia." In the female the nidamental glands are supplied by branches of the branchio-osphradial arteries (3). I retain the name "branchio-osphradial" for these arteries because although the osphradial character of the papillae referred to is not yet well proven there is still a considerable probability of it, and it does not seem worth while to burden the literature of the subject with a new name which *might* in time prove more correct, but for the present would be no more intelligible or convenient.

The anterior pallial artery now passes forward nearly to the edge of the mantle. It here divides into a right and a left branch (the marginal pallial arteries, 2) which run parallel to the edge of the mantle till they unite dorsally with the pallio-nuchal branches of the dorsal aorta. In this way a remarkable arterial circuit is formed to which Willey has given the name "circulus pallialis."

From the anterior side of the marginal pallial artery a regular series of small arteries (1) pass into the portion of the mantle in front of the marginal artery, which we have noticed to be especially muscular and slightly thicker than the middle portions of the mantle.

From the posterior side of the marginal artery, and from the anterior portion of the anterior pallial artery numerous vessels pass into the middle portions of the mantle (20).

The posterior pallial artery (13) bends around the anterior side of the heart immediately after its origin and then passes backward along the ventral surface of the heart. It is here covered by the portion of the pallio-visceral ligament which encloses the heart, and hangs suspended in a mesentery-like fold of this ligament. Running backward under the left side of the heart the artery arrives at the posterior viscero pericardial opening (15), through which it passes by following the right edge; this edge being attached to the gonad, the artery passes directly upon the surface of the ovary or testis, as the case may be. Passing over the lower edge on to the anterior face of the gonad, the artery reaches the gastric ligament, along the edge of which it passes to the posterior wall of the body near the base of the siphuncle. The posterior pallial artery does not appear to give off any branches to the gonad.

Arrived at the posterior wall of the body the artery divides into a right and a left septal artery (9, 12). These ramify over the portion of the body wall which faces the septum. It will be remembered that this portion of the body wall is bounded by the dorsal and the posterior ventral aponeurotic bands. The branches of the septal arteries are rigidly confined to the septal area of the body wall.

The siphuncular artery (11) arises as a branch of one of the septal arteries, sometimes of one, sometimes of the other. Entering the base of the siphuncle the artery extends through it to the end. Other smaller branches of the septal arteries may also enter the base of the siphuncle (10).

The Anatomy and Development of the Reproductive Organs of Planaria maculata. By WINTERTON C. CURTIS.

During the summers of 1898 and '99 while at the Marine Biological Laboratory, Wood's Holl, Mass, I became interested in studying the common *Planaria maculata* which is abundant in almost every fresh water pond about the town. Some very large specimens 15-20 mm. in length, were found in the ponds near Falmouth and with them large numbers of eggs, which they lay during May and June. Reproductive organs were of course fully developed in these specimens and I studied their anatomy casually while endeavoring to ascertain new facts regarding the function of the uterus, penis, etc., during the egg-laying. At this juncture I was surprised to read in a recent paper by Woodworth the following sentence, "*Planaria maculata* is the commonest of our fresh water Planarians and was the first one to be described (Leidy, 1848); however, nothing has been published regarding its sexual organs, and I am unable to offer anything in this regard; not one of the hundreds of specimens that came under my observation was sexually mature."[1]

Since the anatomy of the most complexed system of organs in this common species is entirely unknown or at least unrecorded, I have availed myself of the opportunity to study carefully the reproductive organs in their fully developed state and find out if possible why so many individuals have been observed, by Woodworth and others, with no trace of reproductive organs. In September of 1899 I collected small specimens in the vicinity of Baltimore, which, upon examination, were found to have their reproductive organs just developing. This paper aims merely to state the facts thus far ascertained regarding the development and adult condition of these organs.

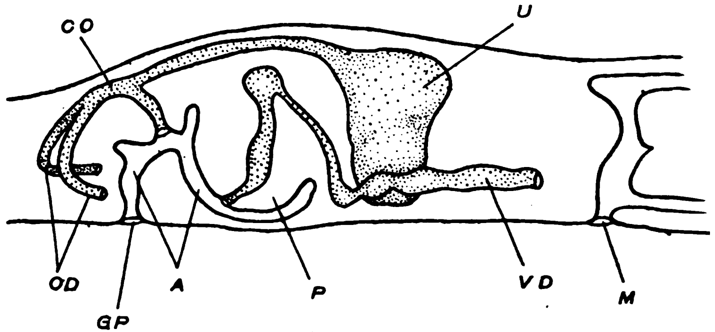

FIG. 1.

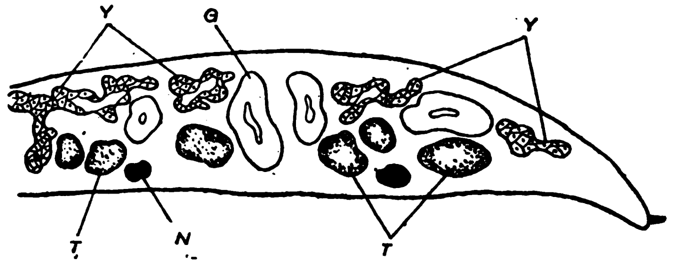

FIG. 2.

The general arrangement does not differ greatly from what has been found repeatedly in other Planarians. The testes are very numerous and extend from the region of the oviducts almost to the tail. Though a few large follicles are to be found extending up between the gut lobes, the rest are packed closely together in the ventral region and never found dorsal to the gut. Their lateral extent is seen in transverse section of the animal (Fig. 2), to be from a point about half way between the lateral margin of the animal and the nerve cords to within a short distance of the median line. Everywhere they are close together and from the ovaries to the tail hardly a section can be found that does not cut a half dozen or more. In longitudinal sections they are arranged one after another like a row of billiard balls; there are something like 75 on either side.

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[1] This name, given by Willey, is entirely improper, since the artery is distributed to the body wall and not to any portion of the mantle.

[1] I. Contributions to the Morphology of the Turbellaria. Bull. Mus. Comp. Zool., Harvard College, Vol. XXXI., No. 1. Contributions to the Morphology of the Turbellaria. II. On some Turbellaria from Illinois, Vol. XXXI, No. 1.

Testicular canals (vasa efferentia) are everywhere found connecting one testis with another or in the region of the pharynx connecting the testes with the vasa deferentia. It has seemed to me in studying these fine canals that there is no reason for doubting that each testis has a definite connection either directly or through intervening testes with the vas deferens. In forms with a smaller number, each testis connects with an elongated vas deferens. In *Planaria maculata* the testes communicate with one another and ultimately with the vas deferens. During the egg-laying season the vasa deferentia are so distended by spermatozoa as to form large seminal vesicles extending as far forward as the front end of the pharynx. Here they decrease suddenly in diameter and can be followed only a very short distance farther. Practically the whole vas. deferens has been converted into a seminal vesicle. In the live worm they may be seen through the ventral surface as two whitish masses on either side in the region of the pharynx. Posteriorly the seminal vesicles narrow suddenly and the fine tubes thus formed turn with a sharp angle and mount dorsally to the base of the penis where they unite to form the penis lumen. This lumen is of considerable size, but opens by a much smaller aperture.

The penis (Fig. 1, *p*) is short and thick, closely invested by the walls of its cavity and pointing downward and backward at an angle of about 45°. Behind this anterior part of the atrium which contains the penis, the atrium is narrowed abruptly so that it becomes a canal leading straight back. It is worth noting that the longitudinal axis of the penis does not point in the direction of this opening but downward and backward as above described, and thus the free end of the penis lies somewhat below the opening through which it must pass when protruded. The length of this narrow canal is usually equal to about one half the diameter of the penis. It then sends off a canal of equal diameter downward and slightly backward which communicates with the outside at the genital pore. A similar part, the vagina, extends dorsally pointing backward at a small angle. This reaches almost to the basal membrane on the dorsal side before it splits into the stalk of the uterus running forward and the common oviduct running backward on the mid-line (Fig. 1.) The posterior surface of the vagina is thrown into one or two large folds which run lengthwise and sometimes appear like a miniature penis. There is, however, no such structure and the atrial cavity is no farther complicated than by the division into an anterior portion containing the penis and a posterior which receives the female elements. Besides the secretion of the unicellular glands surrounding the atrium its epithelial lining seems to be actively at work producing a secretion which appears as spherical masses detaching themselves from the cells and covering the surface several layers deep.

The stalk of the uterus as above mentioned extends forward from the vagina along the mid-line as a small tube which in many places shows indications of contraction or rather the possibility of dilatation for the outline of its lumen is folded. In front of the penis it expands into a spherical cavity, the uterus, such as is found in many Planarians (Fig. 1, *u*.) During the egg-laying season, this cavity, when seen in transverse section, is as large as the pharyngeal pocket and extends right up to the dorsal and ventral basal membranes. Within the uterus I have found masses of spermatozoa, and in some cases the egg-capsule in process of manufacture. Almost every live specimen when looked at from the ventral side shows a reddish brown mass in the position of the uterus, as though the uterus contained one of the brown egg-capsules. This color is, however, usually due to the color of the uterus itself for it shows exactly the same when there is no trace of a capsule within.

Opposite the place where the uterus stalk leaves the vagina the common oviduct leads off posteriorly. It very soon divides and each oviduct extends forward just above the nerve-cord as in other forms. What I have seen of the oviduct leads me to think that it is in the same condition as the stalk of the uterus, viz. capable of great distention. Its appearance is like that of all planarian oviducts, but because of its functional activity at this season it seems to give a clearer indication of what kind of a tube the oviduct really is. While I have not yet found ova in the ducts of any specimens, the lumen must be greatly enlarged to permit the passage of the ova and the large numbers of yolk cells which proceed down it to the uterus. If a tube having a lumen sufficiently large for this should contract in such a way that an inner part which lined the lumen did the contracting, while the remaining thickness accommodated itself to this change, we should have a cylinder fluted on the outside and with a denser substance immediately surrounding a small internal cavity. This is what the planarian oviduct is like, and I believe the above explanation is a reasonable one.

The yolk-glands are connected with the oviduct everywhere along its length and their cavities open into its lumen. Only one kind of cell is to be found in the ripe yolk-glands and these are loose in the cavity like so many enormous spermatids in a testis. These yolk-glands extend everywhere, filling the space on the dorsal side and between the gut-lobes so completely that there seems little room left for parenchyma. As they are kept out of the ventral region by the numerous testes the result is that the yolk-glands are dorsally placed. They do not have any definite position like the testes which remain in that part of the parenchyma where they first appear, but seem rather to have grown in and taken all the space that was left. Anteriorly they extend only a short distance in front of the ovary, but like the testes extend back almost to the tail.

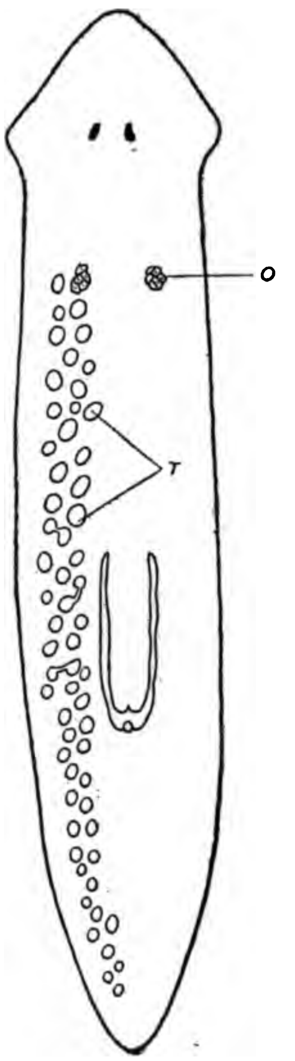

FIG. 3.

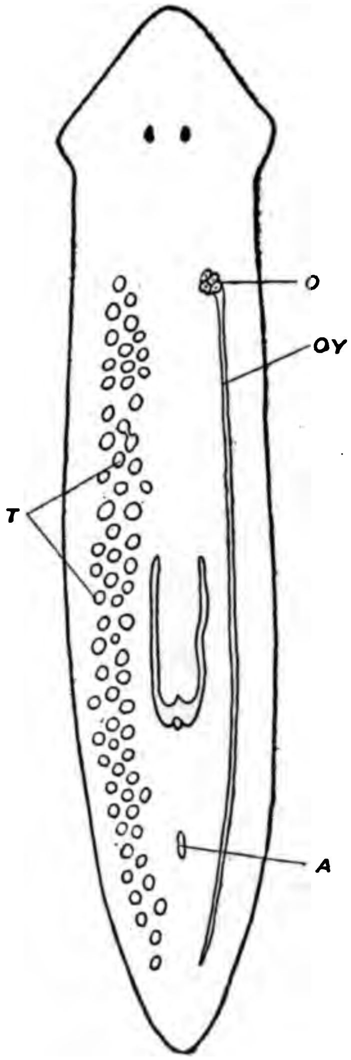

FIG. 4.

The ovaries which lie one-fourth the entire length of the animal from its anterior end are in the usual ventral position above and inside the nerve-cord. They are of considerable size, often more in diameter than one-half the dorso-ventral thickness of the worms. The ova are of all sizes, the largest being found in the center almost within the head of the oviduct and entirely free, evidently already for laying. Only upon the very outside are small spherical cells which probably represent the supporting frame work often described in Planarians. But there is no supporting frame work in the centre and the spherical cells of the periphery which might represent it pass by insensible stages into the smallest ova. The ovary is therefore made up entirely of ova of different sizes most of them very large and ready for their departure. The appearance of the yolk-glands and testes in a cross section of the animal is shown in Fig. 2.

There is nothing like a parovarium and the ovary is compact without irregular lobes extending into the parenchyma.

In the foregoing I have described the structure of the organs when in full activity; in the following I shall describe the stages in their development which I have observed. These were studied in small worms, 5-8 mm. in length, collected in the vicinity of Baltimore during October 1899. In the youngest specimens found the ovaries can be made out in the same relative position as in the adult. The testes also are in the same relative position and connected everywhere by short thick rods of cells which are destined to be the testicular canals. Such a stage seen from above or below might be represented by a diagram like Fig. 3. I have only one specimen of this early stage and cannot be certain whether any trace of the oviduct has made its appearance. There is no trace of the genital-atrium.

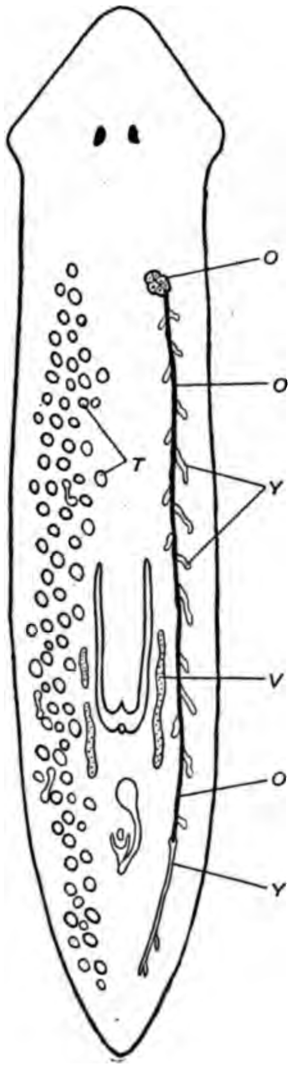

FIG. 5.

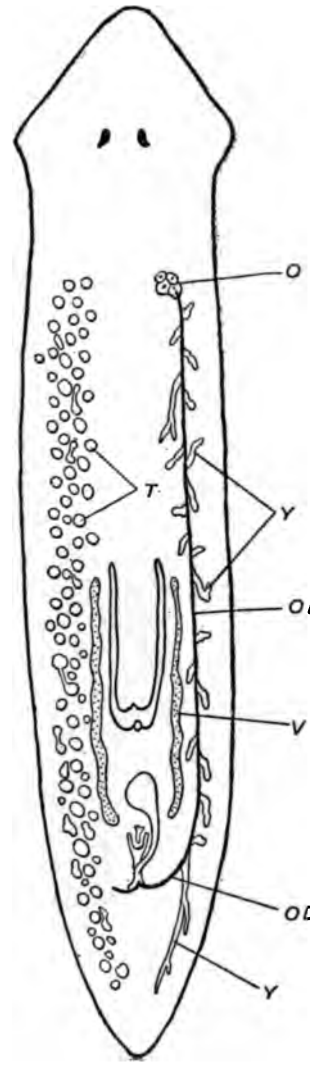

FIG. 6.

At a stage slightly older than the above (Fig. 4), there appears in the region of the genital atrium a cleft in the parenchyma (Fig. 7.) This is preceded by a noticeable collecting of parenchyma cells at the spot. Lining the cleft an epithelium is formed in the same way as in the embryo the pharyngeal pocket develops its lining. In this stage the anlage of the oviduct is unquestionably present, for extending back from the outer side of each ovary and along above the nerve-cord in exactly the position of the oviduct lies a rod of cells the structure of which is identical in appearance with the cords of large cells so familiar as the early stages of the yolk-glands. This rod of cells extends past the beginning of the atrium well down into the tail. There are at this time no other cell-cords of this sort in any part of the worm. Such a stage might then be represented by a diagram like Fig. 4.

Following this there are to be found along the line of each oviduct ma cords of cells seeming to have grown out from the original rod, at any ra they are connected with the primary rod. Figure 5 is a representation the condition which now exists. The part which is to become the ovidu has now in some places the beginning of a lumen, in others is still a sol rod of cells as at first. Posteriorly the oviduct anlage still extends back

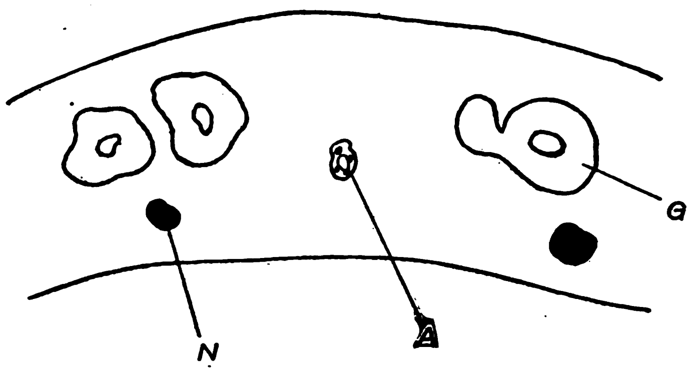

FIG. 7.

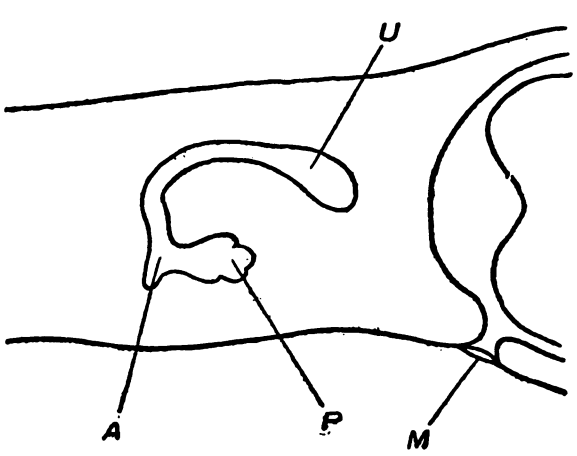

FIG. 8.

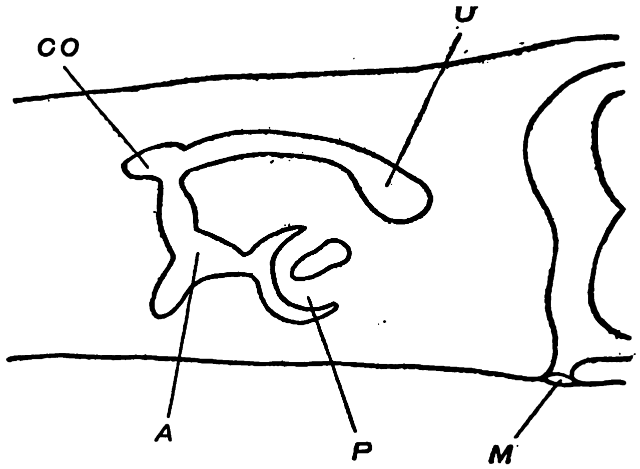

FIG. 9.

the atrium. At this stage there seems to be the beginning of the vas deferens, for on either side, spaces like enlarged testicular canals can often be traced some distance in more than one place.

The atrium is much farther advanced in the next stage shown and can be best seen from a side view (Fig. 8). It is already divided into the penis-cavity, uterus and vagina.

The ultimate connection of the atrium to the outside, already indicated in Fig. 8, is more pronounced in a slightly later stage (Fig. 9), and from

1 of the vagina opposite the uterus stalk is found an outgrowth
ıg the common oviduct. The penis has also appeared and within
ty lined with epithelium, but this does not yet open to the outside.
deferens can be identified in the region of the pharynx, though it
connect with the penis. The oviducts are found and can be iden-
ɔm the ovary to the region of the atrium, where they pass into a
rd extending toward the tail. Throughout their length they are
ɪd at frequent intervals with the yolk-glands. There is as yet no
f either oviduct with the vagina. Figure 5 would represent the
of the parts in such a stage.

but a step to the next which is practically adult. In Figure 6,
mains stretching down into the tail upon either side, a solid rod of
w to be identified as the yolk glands of the posterior end. This is
ıme position as the primary rod out of which anteriorly the oviduct
le. It can be readily traced with its connected yolk-glands as indi-
ı the diagram and becomes continnous with the oviduct where the
ends inward to reach the common oviduct. The cavity of the
ıas increased in size, the lumen of the penis opens to without and
al-pore is formed. This is the adult condition save that the vasa
ia are not connected with the penis lumen. The yolk-glands are
rger and pass from the oviduct up between the gut-lobes at frequent
s.

ention has been made in the above of the condition of the ovaries
es for they have not changed greatly. Both are larger than at
ovaries with more large ova, the testes with their cavities contain-
matids of all sizes. Connecting the vasa deferentia with the penis
t condition is reached.

are in the development two distinct parts, the germ-cells and the
y organs about the atrium. They originate separately and later
connected with one another. There are laid down two solid rods of
tending from the ovaries well back into the tail. These anteriorly
the oviducts, while back of the atrium they remain the same and
yolk-glands. So far as I can make out the yolk-glands arise as out-
of these primary rods of cells. The organs of the atrium begin as a
the parenchyma which gradually becomes differentiated into the
parts. I cannot determine from the material I now have whether
e and female cells originate *in situ* or first make their appearance in
d areas and spread thence to the positions they occupy in the adult.
regard to clearing up the fact recorded by Woodworth that very
ıdividuals of this species are often found without reproductive
the solution of the problem would be best reached by observing
one or more localities the year round. I have not been able to do
from the facts above noted it seems to me likely that this form does
elop its reproductive organs until a considerable time after its other
ıre fully developed. I hatched the young worms from the capsule
l's Holl and kept them alive for several weeks, but none of them
any sign of these organs. In October I found slightly larger worms
ıltimore developing their organs as above described. As I have
thing to indicate the laying of winter eggs during the fall, I con-
ıat the sexual products ripen slowly and in the spring the worms
very large with the approach of sexual maturity. The worms which
ɔrth studied were collected mainly during the summer months, and
unlikely they were the young of that year, which would develop
gans in the fall. Small individuals of these species are described
Randolph,[1] who studied them at Wood's Holl, as reproducing by
It seems that there are some other very interesting facts to be
in the life history of this form, and I shall try to obtain more exact
ɔn this problem.

EXPLANATION OF LETTERS IN FIGURES.

rium.
mmon oviduct.
t.
enital pore.
ɔuth.
rve.
ary.
Od.—Oviduct.
Oy.—Anlage of oviduct.
P.—Penis.
T.—Testis.
U.—Uterus.
Vd.—Vas deferens.
Y.—Yolk-glands.

ɔned by Woodworth in the above paper.

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NOTES FROM THE PHYSICAL LABORATORY.

EDITED BY PROFESSOR JOSEPH S. AMES.

Resistance to Ethereal Motion. By H. A. ROWLAND, N. E. GILBERT and P. C. MCJUNCKIN.

An attempt has been made to determine within what limits it is possible to say that there is no frictional or viscous resistance in the ether of space. Modern theories of magnetism are based on some kind of rotary or vortical motion in the ether and if a piece of iron is magnetized we imagine that the molecules, or something about them, rotate also. The existence of permanent magnets shows that any retardation due to any kind of resistance must be very slight.

In the case of an electro-magnet, any energy used in overcoming such resistence, if it exists, must be derived from the exciting current and the disappearance of such energy will produce an apparent resistance added to that of the wire. An attempt was therefore made to determine whether a wire carrying a current had the same electrical resistance when producing a magnetic field that it had when not producing it.

The experiment consisted in winding two coils of wire together on an iron core and determining whether the resistance was the same in two cases:—

(1). When the current was so passed through the coils that both produced a field in the same direction.

(2). When the current was so passed that the fields produced counterbalanced each other.

The great difficulty in the experiment lay in the necessity of measuring the resistance of a coil in which a comparatively large current was flowing. In order to overcome the effect of changes in resistance due to changes in temperature, two coils were wound, as nearly as possible identical, and these double coils were used for the four arms of a Wheatstone's bridge so that the temperature would rise in all four arms equally. Each coil consisted of about 2,500 turns of doubled No. 30 copper wire, the whole enclosed in an iron case, boiled in wax for five hours and cooled in a vacuum. The insulation resistance was then about eleven megohms. Iron cores were used and it was found that the cases effectually protected the coils against sudden changes in temperature due to air currents as well as serving for yokes to the magnets. A current of one-tenth ampere was used which insured a high state of magnetization in the iron when two coils were in series, giving 5,000 turns.

The coils were connected in the bridge in such a way that the two coils in one case formed the opposite arms of the bridge. By means of a reversing switch the current in one of these coils could be reversed. This changed the field which might affect two opposite arms of the bridge and thus doubled the deflection. Another switch might have been inserted in the other pair of arms and thus doubled the deflection again but errors due to the switches would also have been doubled and no advantage gained. The switch was carefully constructed with large copper rods dipping into copper mercury cups but, at best, the inaccuracies of the switch limited the accuracy of the experiment.

The fine adjustments were made by resistance boxes shunted round one of the coils. About 15,000 ohms in this shunt balanced the bridge. A change of one ohm in the shunt gave a deflection of two millimeters and indicated a change in the resistance of the arm of $\frac{5}{100000}$ ohm. The whole resistance being over 100 ohms this would give a determination of one part in 2,000,000 or, since the deflection is doubled, one part in 4,000,000 for each arm. The result of 30 readings each way was that the shunt resistance was about 3.4 ohms less with magnetic field than without. The shunt was so placed that this gives a less resistance by one part in 1,200,000 when producing a magnetic field.

The above result is in the wrong direction. The difficulty may lie in the fact that the galvanometer, though used at night, was unsteady at best, or it may be due to leakage. The resistance of the coils was 100 ohms while the insulation resistance was 11,000,000 ohms. If the leakage is symmetrical along the doubled wire it will not affect the galvanometer upon reversing the current in one coil. This assumption may not be justified.

Apparatus and Plans for Operation at the Total Solar Eclipse, May 28th, 1900. By J. S. AMES.

The physical department of the Johns Hopkins University was invited by Professor S. J. Brown, astronomical-director of the U. S. Naval Observatory at Washington, D. C., to co-operate with the Naval Observatory in preparations and observations, for the total eclipse on May 28. The path of totality was to extend from New Orleans to Norfolk, across all the intervening States; and arrangements were at once made to establish stations for observations at two points, one at the centre of the path, the other near the northern edge. The former was at Pinehurst, N. C.; the latter, Griffin, Georgia. At or near each of these places there was a station of the staff of the Naval Observatory.

The main features of interest to the physicist seemed to be the nature of the chromosphere and the corona; and for the purpose of studying these special apparatus was designed and constructed, largely under the direction of Mr. L. E. Jewell and Dr. N. E. Dorsey. Four spectroscopes were constructed, two for concave gratings, two for plane ones; and one of each was installed at each of the stations. The mounting of the plane-gratings was as follows: the light which would come from the heliostat would enter a light-tight box, fall upon the grating, and be diffracted so that the first spectrum focused by a quartz lens would be incident upon the photographic plate. The axis of the lens was so turned, and the photographic plate so bent that correction was made as far as possible for the spherical and chromatic aberration of the quartz lens. The box containing the apparatus was turned and supported at such an angle that the lines of the grating were parallel to the line of cusps at second contact. The gratings had 15,000 lines to the inch and a ruled surface 3 x 5 inches.

The concave-gratings were mounted as in the usual Rowland form; the slit, grating and centre of camera-box being held by steel tubing in their proper positions. The whole apparatus was enclosed in a light-tight box which was so tilted that the slit was parallel to the line of cusps at second contact. The light from the heliostat was focused on the slit by a quartz lens. The gratings were of about 10 feet radius, and had 15,000 lines to the inch.

The plan of operations with the instruments was designed to be as follows: With the plane grating spectroscopes it was arranged to take a series of exposures during totality, of various durations, so as to secure the spectra of different layers of the chromosphere and corona. For this purpose a sliding camera was constructed, which allowed five consecutive exposures. With the concave gratings a similar series of five exposures was arranged for. The slit was to be left wide open, and the different layers of the chromosphere were to be kept in the same position in the open slit by the aid of an eye-piece and focusing screws attached to the quartz lens. The eye-piece was provided with cross hairs, and was to be so placed as to have the F (hydrogen) line of the second spectrum in focus. When, owing to the gradual eclipsing of the layers of the chromosphere the layer which is serving as the slit of light would be displaced sidewise, it could be brought back to the proper position by the slow motion of the quartz lens. At the middle of totality, the image on the slit could be shifted the necessary amount to bring the other edge of the sun under observation.

With all the grating spectroscopes adjustments were made so as to photograph as far as possible into the ultra-violet.

It was thought important to make further study of the polarization of the corona; and three different pieces of apparatus were constructed for this purpose. One was devised to take a series of photographs of the corona through a large double-image rhomb, which was placed in succession at different azimuths. The image of the sun was to be formed by a lens, 18 inches focus, thus having a diameter of one-fifth of an inch. In a second tube, fastened to the first, a similar plan was arranged with a direct-vision spectroscope of large dispersion, in order to see if by any chance the bright line spectrum of the corona was polarized. A pile of glass

also arranged in such a manner as to give some idea as to the
of polarization in any one layer around the sun, and also out
dius.

lteration in the Undergraduate Courses in

. By J. S. Ames.

sent system of undergraduate instruction in Physics at Johns
University includes work for two years, so-called Minor and
rses. Each consists of four hours a week class-work, three hours
d one hour recitation; there is also laboratory instruction in
with each course, from three to six hours weekly. The minor
general one, and treats the whole range of Physics in an ele-
anner; the major course is largely mathematical, being the
of the methods of the calculus to physical phenomena. It has
that this latter course is rather difficult for undergraduate
and it is proposed to substitute for it in following years a course
be largely descriptive, with only such mathematical discussion
lutely essential for a proper understanding of the subject.
tention will be given modern developments in various fields of
nd there will be many illustrative experiments performed in the
. Full description will be given also of the general classical
ts on which our exact knowledge of Physics is based. In this
oped to make the course both more interesting and more profit-
undergraduate students and also to such graduate students as do
the necessary information.

ill be also a course on elementary Mathematical Physics for the
tudents in Physics, which will introduce the student to the more
and theoretical portions of the subject. This course will be a
one, extending through three years, and will embrace such sub-
echanics, hydrodynamics, thermodynamics, electric oscillations,
ptics, spherical and Bessel functions, general mathematical
the theory of the potential, etc.

course of instruction, consisting of laboratory instruction and
tions, has been arranged for medical students, and will probably
this coming scholastic year.

ction of Short Wave Trains. By N. E. Dorsey.

dering the refraction of light a question at once arises as to
he medium requires time to settle down to a steady state. If
hort train of waves will be refracted differently from a long one
e wave-length. As there were no data bearing on the subject,
H. A. Rowland requested me to investigate it. As outlined by
Rowland and carried out by Mr. A. W. Ewell and myself, the
t was as follows:

Grubb prism spectroscope with four 60° inch prisms and two half
th a reflecting prism at the end, so that it had an effective train
prisms, was adjusted so that its eye-piece was near that of a
ing spectroscope giving about the same dispersion in the green.
rsection of the prolongations of the two collimators was placed
p fed with a magnesium salt, and the spectroscopes were adjusted
little b" group appeared as nearly as possible the same in both.
arc was replaced by a very quick spark between magnesium
nd the lines were again examined in both instruments.

y train of light waves we can deal with is very long in com-
th the wave length of light, the effect looked for will make itself
ly by a modification of the appearance of the lines. In fact we
, superimposed on the ordinary line, the line due to the initial
e. This should cause the line to broaden or to appear hazy on
edges. In order to notice an effect of this kind a comparison
ssary and for this reason the grating spectroscope was set up, so
uld observe in quick succession the ordinary line as given by the
d the one given by the prism spectroscope.

o the faintness of the spectrum given by the prism instrument
are entirely negative in character, but there was not the slightest
of any change in the appearance of the lines. In our case indeed
ere was really no change; for although the entire duration of
of the spark was not more than 10^{-6} or 10^{-7} seconds this is a very long time as compared with the period of light waves. As stated above, it was not possible to use a quicker spark owing to the faintness of the spectrum.

The intensity of the spectrum furnished by the prism instrument was so much less than that from the grating, that it seemed advisable to make a rough comparison of the efficiencies of the two instruments. By the efficiency of a spectroscope I mean the ratio of the product of the intensity of spectrum times its width to the total amount of light falling on the first prism or grating, as the case may be. As the average of several observations I found that the grating spectroscope (a very ordinary grating was used) was 3.5 times as efficient in the red, 4.6 in the yellow, 5.9 in the green, and 7.9 in the blue, as the Grubb spectroscope. I used the spectrum of the first order.

Notes on the Zeeman Effect. By H. M. Reese.

Preliminary notes of this investigation, were published in these *Circulars* in June, 1898, and June, 1899.

During the present year the spectra of magnesium, cadmium, zinc, mercury, carbon, iron and titanium have been investigated. For this work a large new magnet was constructed with pole-pieces 1½ inches in diameter, which gave a very uniform field of 26580 C. G. S. units under working conditions. The other apparatus is substantially the same as that formerly used, and reference may be made to the former publications for description.

The lines 4678.37, 4800.09, 5086.06 of cadmium, 4680.38, 4727.26, 4810.71 of zinc, and 5167.55, 5172.87, 5183.84 of magnesium, were used to determine the variation of the separation with the magnetic field. A series of photographic plates were taken of the cadmium and zinc lines, using a spark between cadmium and zinc terminals, with the field varying from 6125 to 26580 C. G. S. units. A similar series was taken giving the magnesium lines and the cadmium line at 5086.06. After the separation was measured on all the plates a curve was plotted for each line, having magnetic forces as abscissae and separations as ordinates. For the lines 4678.37 4680.38, 5167.55, which are sharp triplets, the curves are straight lines with an indication of a possible drooping toward the axis of abscissae at more intense fields. The curves for the lines 4800.09, 4722.26, 5172.87, all sextuplets, show a more decided tendency to droop at high fields, and in those for 5086.06, 4810.71, 5183.84, diffuse triplets, this tendency is very marked, although in all cases the lower part of the curve is perfectly straight. It seems then that for many lines the separation is proportional to the strength of the magnetic field only for rather weak fields.

A few plates were taken of the spark between carbon terminals. The carbon band at about 3800 shows not the slightest indication of magnetic effect for a field of 25000 units, but these plates are mainly useful for the impurities that were in the carbon, and whose spectra appear on the plates. Many iron lines appear, and are all well-defined and in most cases well separated. This is really a very good means of getting the iron spectrum in measurable fields for iron terminals greatly change the distribution of the lines of force. The silicon line 3905 also appears with a separation of .209 Å.U. between its lateral components for a field of 25000 units. For the same field the aluminium line at wave-length 3961 and the calcium line at wave-length 3933 appear as triplets with separations .24, and .22 respectively; while the aluminium line at 3944 and the calcium line at 3968 are quadruplets. For the former the separation of the outer components is .28 Å. U., that of the inner ones .14, while for the latter that of the outer components is .28, of the inner .145.

On a plate taken with titanium, three lines appear, at wave-length 3658.3, 3759.4, 3761.4. In a field of 25000 units, all these are clear, well-defined triplets, with separations of .27, .31, and .35 Å. U. respectively.

Recently the question of the symmetry of the magnetic group has been brought forward by Voigt, whose theory indicates that for weak fields it should be asymmetrical as regards both intensity and location. Zeeman has verified this for several lines. Besides the iron line at wave-length 3466 which, as reported in this *Circular* last year, appears to be asymmetrical as regards spacing, several other lines have been observed here which show the same peculiarity. For weak fields the "sharp triplets," already spoken of in the cadmium and zinc spectra, have the violet component farther removed from the central than the red component, but less intense. In the case of the sextuplets, which appear as quadruplets in weak fields, the mean of the inner component is farther to the violet than that of the outer; and the outer line on the red side is more intense than that on the violet side. For the diffuse triplets no measurements of the lateral separation were taken, but the red component is the more intense. All these lines become more symmetrical in all respects as the field increases.

I was assisted in this research by Mr. N. A. Kent, who will continue the work next year.

Note on the Conductivity of Solution of the Alkali Metals on Methyl Amine. By C. A. Kraus.

In studying the properties of solution of the alkali metals in liquid ammonia the conductivity of a lithium solution in methyl amine was tested in hope of its proving a good substitute for the metal-ammonia solutions. This solution was studied by Moisson.[1] It was found, however, that while the solution conducts, the conductivity is so low that it is of no value in the study of the conductivity of the metal solution. While according to Moisson, sodium and potassium are quite insoluble in methyl amine it was found that these metals dissolved very slowly and sparingly in the sample of liquid used. The liquid was purified by distilling from the lithium solution. This removes moisture and it is also highly probable, in view of the reaction between the alkali metals and ammonia, that the ammonia would also be removed. The solutions are blue, as are the other metallic-solutions, but so weak that one can see through a saturated solution one-half centimeter thickness. Potassium is much more soluble than sodium. Both metals react with the solvent, although slowly, the blue color disappearing at ordinary temperature only after five or six hours. A tube containing about a fourth of a grain of potassium in 1 cc. of methyl amine was heated to 100° C. After about eight hours the metal had all reacted with the solvent, leaving a yellowish-colored solution with excess of crystals of the reaction product in the bottom of the tube. On cooling, more crystals were deposited. Hydrogen was given off during the reaction and was found on opening the tube. The crystalline compound is probably a substituted methyl amine formed according to the reaction—

$$CH_3NH_2 + K = CH_3NHK + H.$$

This compound reacts violently with water, the gases igniting. It is certain that the methyl amine contained insufficient ammonia to enable the formation of potassamide.

The solution of sodium and potassium also conducted, but also to a small extent compared with the ammonia solutions. There was some polarization, but it was very small, and is easily explained by the presence of the amide which is constantly being formed.

It may also be noted that sulphur in methyl amine conducts the current, but with marked polarization and with decomposition of the solution. The products of this decomposition have not been studied.

The Spectra of Mercury. By W. B. Huff.

In 1894 Eder and Valenta announced their discovery of the band-spectrum of mercury in vacuum tubes and that by the use of capacity in the secondary of the induction coil, this band-spectrum could be broken up into one consisting of a very large number of lines.

The object of the present investigation was to make a detailed study of the spectra of mercury in tubes, with particular reference to transition spectra obtained by varying the conditions of the discharge through the tube at various temperatures and pressures.

Preliminary to the work with tubes, the arc-spectrum was obtained, substantially as given by Kayser and Runge, with the addition of some lines in the extreme ultra-violet.

The spectrum of the spark in air was studied with the large concave grating of 21 feet radius. The discharge was from a large induction coil whose primary carried an alternating current. With no capacity in the secondary, the discharge from this coil gave the spectrum of the arc. With capacity the characteristic spark lines were brought out. With a large capacity, the lines become very hazy and there was much continuous spectrum. Other conditions being the same, a long spark gave lines not found in the spectrum of a short one.

Self-induction with capacity in the secondary cut out the air lines and some lines peculiar to the spark. The continuous spectrum disappeared and the lines came out more sharply.

When the discharge from an ordinary induction coil was passed through a vacuum tube with mercury electrodes, the light directly from the surface of the mercury gave the bands.

Heating the tube strongly caused the bands to disappear. With mercury distilling through the capillary, the introduction of capacity in the secondary brought out the line spectrum. The number of lines in this spectrum increased with increase of capacity. Self-induction cut out many of the lines of this spectrum and, as in the case of the spark in air, tended to reduce the spectrum to that of the arc.

As the pressure in the tube was decreased, the capacity necessary to break up the bands became less and the resulting lines were sharper. The relative intensities in this spectrum were very different from those in tubes sealed off at higher pressures, but when heated, a low-pressure tube gave substantially the same lines as were found in the spectrum of one containing a larger amount of air. In the spectrum of low-pressure tubes heated only by the discharge, several groups of lines were found which could be identified directly with groups of air lines on plates of the spark in air. When the tube was heated until the mercury distilled freely through the capillary, these air-lines could no longer be traced on the plates.

Plates showing the entire tube were also obtained by means of a plane grating used as objective. When the tube was cool, bands were seen through the entire length of the discharge. Heating the tube slightly and using capacity, the bands were broken up into lines in the capillary only With strong heat, the bands disappeared wholly and much continuous spectrum came out at the electrodes.

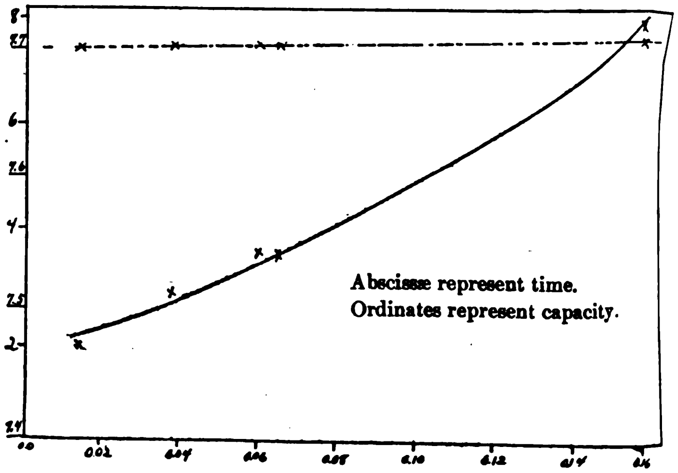
An examination of tubes with external electrodes showed bands throughout the tube, and very strongly on each side of a globule of mercury in the capillary.

The results from using an ordinary induction coil were the same as those from using a strong alternating discharge.

Electric Absorption in Condensers. By L. M. Pot[illegible]s.

In the *University Circular* for June, 1899, there was a note on Electric Absorption in Condensers by the author. The work reported then has been continued and some additional results obtained.

The method there described for the measurement of the electric absorption as a resistance has been used in the present investigation. In the note referred to, the resistance due to the electric absorption in a condenser, made in a vacuum under pressure, was shown to vary directly as the period of the current, and was shown to be independent of the strength of the current. In addition to the results obtained then, the value of $\frac{A}{T}$ (i. e., the value of the electric absorption in ohms at period T, divided by the period T) has been determined for various temperatures. The temperature was found by a thermometer thrust through a hole in the box enclosing the condenser. From this investigation it was found that, at



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[1] *Comptes Rendus*, Vol. 128, p. 20, 1899.

ordinary laboratory temperatures, a change of 0.1° C. caused a change of nearly 1 per cent. in the value of $\frac{A}{T}$.

The electric absorption of two one-third microfarad condensers was also studied. The relation here between the electric absorption A and T was not the simple relation found in the case of the wax condenser. From $T = .09$ sec. to $T = .04$ sec. the value of A could be represented by a formula of the form $aT - b$. For T less than .04 sec. the curve is slightly concave upwards.

From the theory of electric absorption given in the June *Circular*, 1898, it appeared that the capacity should also show a variation with the period. For a test of this point the method used was one described in the *American Journal of Science* for December, 1897, by Prof. Rowland (method 3). The different sources of error were tested, namely, electrostatic action, and induction of different parts of the apparatus on one another. The corrections due to electric absorption and self-induction of the coils of the electro-dynamometer were also studied. After the apparatus had been arranged to as good advantage as possible, results were obtained which agreed to 3 parts in 1,000 for varying conditions. The curve given in the figure shows the relation between the period and the capacity. The curve is drawn on two scales, the broken line on a small scale and the full line on a larger scale to show the nature of the variation of the capacity with the period. The term in the capacity depending on T does not appear to vary far from being proportional to the first power of T.

The final results of the investigation verify the theory in as far as a condenser possessing electric absorption acts as a certain capacity in series with a resistance. The value of the capacity and resistance each being dependent on the period of the current. However, the nature of the variation does not agree with the theory.

Rowland's New Method for the Measurement of Hysteresis and Foucault Current Losses in Iron and the Detection of Short Circuits in Coils. By L. M. Potts.

In the *American Journal of Science*, December, 1897, Professor Rowland suggested a method for the measurement of hysteresis and Foucault current losses in iron. In the work reported below some tests of this method have been made.

The same arrangement is used as described in *American Journal of Science*, July, 1899, for the measurement of electric absorption. It merely consists of a Wheatstone bridge in one arm of which a large coil of wire and the fixed coils of an electro-dynamometer are connected in series. The hanging coil of the electro-dynamometer is in the cross connection of the bridge. The bridge is adjusted for no deflection as in the application to the determination of electric absorption. A few plates of transformer iron, in which the hysteresis and eddy current losses are desired, are fitted around the coil. The energy losses in the iron act, as in the case of electric absorption, as an added resistance in series with the coil. The current flowing through the coil was determined by passing a small part of it through an electro-dynamometer. From the value of the current i, the period of the current T, the volume of the iron v, the value of the resistance due to the losses in the iron H, we have that the energy loss per cycle, per cc. is

$$\frac{i^2HT}{v}.$$

The value of the corresponding induction in the iron B was determined by measuring with an electro-dynamometer the electromotive force induced around a small coil encircling the iron. The values thus determined for different values of the induction B and T constantly gave a very nice curve, plotting the energy loss per cycle, per cc., and B per sq. cm. of cross section of iron; the values also agreed very well with the curves given for losses in transformer iron, as found by other methods.

For the detection of short circuits the arrangement is the same as the preceding. The bridge is balanced, the coil to be tested is placed on top the coil already in one arm of the bridge, and any short circuit in the coil is shown by a deflection of the electro-dynamometer. The method was tested by using for the coil on the bridge a large coil of 5.3 henries, and laying on top of it short circuited coils of wire wound with different sizes of wire. The method was found quite sensitive. It appeared that if a large coil is used in the bridge a short circuit of only one turn in a coil, made of quite fine wire, may be readily detected. The sensitiveness may be increased by a decrease in the period of the current, and also by filling the centre of the coil with iron.

Some Properties of the Electric Spark and Its Spectrum. By C. C. Schenck.

The following is a preliminary note, the investigation not yet being finished.

The object of the investigation is to study some of the properties of the electric spark and its spectrum, from photographs taken by means of a revolving mirror.

The spark was produced by a battery of six large leyden jars charged by an alternating current, frequency 133 complete periods per second. The current was stepped up from 110 to 750 volts and then put through a specially designed induction coil, which gave a potential of about 10,000 volts. The strength of current through the coil was regulated by a suitable resistance in the primary circuit, which was found to be necessary in order to produce a very noisy spark which should not heat up the electrodes to the melting point. It is well known that when the current is too large for a given capacity, the metal of the poles becomes hot and the spark becomes less noisy and changes in character. It may be mentioned that this arrangement gave about 266 sparks per second for a spark 6 mm. long, although they did not follow each other with absolute regularity, and the number per second could be reduced by about one-half by using a longer spark. The period of oscillation of the battery, found by measuring the image of the spark on the photographic plate, was 1.3×10^{-6} seconds.

To photograph the spark, a narrow, vertical slit was placed as close to it as possible. The light from the slit fell upon a rotating mirror, and was reflected thence through the lens of a camera, and the image of the slit focussed on the ground glass. The mirror was driven by an air blast and rotated about a vertical axis. There was no attempt made to secure synchronism between the appearance of the spark and the position of the mirror, but each discharge was sufficiently brilliant to produce an impression upon the plate.

To photograph the spectrum, it was found, after several trials, that best results were gotten by placing the spark and slit off at a considerable distance, 225 cm., from a single prism of flint glass. After refraction, the light struck the mirror and was reflected into the camera. The prism was carefully adjusted for minimum deviation for the magnesium line λ 4481. Two sets of photographs of the spectrum were taken. In the first series the axis of the mirror was horizontal, so as to draw out the lines of the spectrum in the direction of their length. In the second set it was vertical, so as to broaden out the lines in a direction perpendicular to their length.

When the spark alone is photographed by means of the rotating mirror, the effect of the oscillatory discharge is clearly shown, but the character of the first discharge is different from that of those that follow. The first discharge is shown on the plate by a straight, somewhat broad line of light, showing that the electricity, in passing across the spark gap, lights up its entire path with a brilliant illumination. The next discharge in the opposite direction may produce a similar weaker illumination; the succeeding oscillations, however, do not light up brilliantly their whole path, but produce curved lines of light which shoot out from the poles, and become constantly more inclined as they approach the center of the spark. This means that the luminosity advances from the pole toward the center of the spark with diminishing velocity. It was noticed that the luminosity always proceeds from a pole of the same nature. This has been shown by other observers. (Feddersen, *Pogg. Ann.* 116, 1862; Schuster, *Phil. Trans.*, 193, p. 209.) To determine whether it is the anode or the kathode, the condensers were charged by a Holtz machine, and their electrification carefully tested before the spark passed, by a gold-leaf electroscope. Magnesium poles were used and several plates taken. Each one showed clearly that in this case it is the kathode from which the luminosity advances. Whether the light is due to an actual streaming out of light-giving particles, or simply to an advancing wave of luminosity like that in a Geissler tube, is an open question.

When the spectrum is photographed with the axis of the mirror placed vertically, so as to spread out the lines of the spectrum in a direction perpendicular to their length, it is found that the air lines are slightly broadened, the amount of broadening depending upon the speed of the mirror. The magnesium line, λ 4481, presents the appearance of a broad, inclined stream of light, crossed by a regular succession of ten or more steeper lines, which correspond to the curved lines of light seen in the oscillations of the plain spark.

If we attempt to get the speed of the metallic vapor by measuring the slope of the lines, a difficulty appears at once. The slope of the edge of the line indicates approximately a speed of 5×10^4, while the slope of the steeper lines indicates approximately a velocity of 20×10^4. There may be two distinct velocities. It is possible, however, that the flatter line is a sort of envelope of the successive steeper ones.

When a narrow spectrum is photographed with the axis of rotation of the mirror horizontal, so that the lines of the spectrum are drawn out in the direction of their length, it affords a method of determining the duration of different lines. It was found that the duration of the continuous spectrum which occurs with a strong spark was so short that it could not be measured. The air lines are slightly prolonged. Their duration did not exceed 2.5×10^{-6} seconds. With the metallic lines the most striking peculiarity was that the duration of the principal lines common to the spectra of both arc and spark considerably exceeded that of lines peculiar to the spectrum of the spark. With magnesium, the triplet λ 3838.4, which occurs in the arc, lasted 45×10^{-6}. The line λ 4481, peculiar to the spark, lasted 24×10^{-6} seconds. With cadmium, the arc lines 4678.4 and 4800 lasted 36×10^{-6} seconds. The line 4416, extremely weak in the arc, lasted 18×10^{-6} seconds. With zinc, the arc lines 4722 and 4810.7 lasted 24×10^{-6} seconds. The lines 4912 and 4925, peculiar to the spark, lasted 14×10^{-5} seconds. It should be added that all these metallic lines were knotted as a result of the oscillations, but the beading was more distinct with the lines peculiar to the spectrum of the spark than with the arc lines.

Notes on Rotatory Polarization Produced by Torsion.

By ARTHUR W. EWELL.

The following are a few experiments in continuation of the work described in the *American Journal of Science* for last August and in abstract in the *Physikalische Zeitschrift* for the fourteenth of last February, where it was shown that torsion produces rotatory polarization which is along the axis of torsion, in the opposite direction to the torsion and which is a function of the twist of a degree higher than the first.

Glycerine was stirred in a glass vessel and twisted in rubber tubes with glass caps and examined for rotatory polarization while being twisted, but no indication of rotatory polarization appeared even when the glycerine was cooled below zero degree centigrade.

Next was examined the effect of twisting glass rods when hot and allowing them to cool under twist. Jena glass alone was sufficiently transparent and as no Jena glass rods could be obtained rods were made by caving in heavy glass tubing. To remove the double refraction from the strains introduced in this method of manufacture, the rods were subjected to prolonged heating at a red heat, then twisted and allowed to cool under twist. Here again there was no indication of rotatory polarization. One of these rods, 3 cm. long, which had received a relative twist at the two ends of nearly two revolutions, did not rotate the plane of polarization more than 5°. On account of irregularities in the field it was impossible to set a lower limit.

It has been questioned whether the phenomena are not closely limited to the axis of torsion. Although in the experiments of last year the rotation appeared quite uniform over the entire cross section, in order to more definitely settle the question the following experiments were made:

Twisting glass tubes was first tried, but no determinations could be made on account of poor transparency and double refraction. Therefore, recourse was had to the jelly tubes which had proven so satisfactory in the work referred to above. Calves-foot gelatine was reduced to a jelly by the application of water and gentle heat and poured through a slit in the side into a rubber tube, 6 cm. long and 1.5 cm. internal diameter, with glass plates cemented to the ends and allowed to cool. To exclude rays near the axis of torsion, the central portion of the glass cap at each end was covered with a disk of black paper 5 mm. in diameter. The jelly gave a natural rotation of 5°. When the two ends were given a relative twist of about 60° and held fixed in clamps there was a superimposed rotation of the plane of polarization of about 6° in the opposite direction to the twist, and when the twist was about 135° the rotation was about 33°. The rotation varied slightly in different azimuths relative to the initial plane of polarization, but was very uniform over the annular cross section of the cylinder to which the rays were confined. On removing the paper disks the rotation at the centre was found to be practically the same as that outside.

To test the question still further, a cylindrical tube was made by cementing to glass plates one rubber tube within another, and filling the space between with melted jelly. The tubes were 4 cm. long and the internal diameter of the outer was 1.5 cm. and the external diameter of the inner .65 cm.

When the glass plates at the ends were given a relative twist of about 60° the plane of polarization was rotated 2° degrees in the opposite direction to the twist and 11° when the twist was 90°, the natural rotation of the jelly having been deducted. There was considerable double refraction which made the field of view somewhat irregular and the rotation somewhat variable in different azimuths.

The first mentioned tube was also tested in directions oblique to the axis by covering the ends with black paper except for two circular apertures, 3 mm. in diameter, diagonally opposite. The rotation was reduced as one would expect, being only about 11° for about 135° twist, but there was no appreciable double refraction.

Inductive E. M. F. in Transformers. By J. B. WHITEHEAD, JR.

[Abstract of paper in *Electrical World and Engineering*, May 5th, 1900.]

In the alternating current transformer the secondary E. M. F. at open circuit is that due to the induction in the core set up by the magnetizing current in the primary. When a load is put on the transformer both primary and secondary coils carry current and so each forms a considerable number of ampere turns or a magneto-motive-force; owing to the fact that the reluctance across the coil space is never so large as to allow it to be neglected, these two m. m. fs. set up fields of force, the lines of which in general only thread the particular coil inducing them; thus each of these "leakage" fields is a separate source of self-induction in its own coil, setting up in that coil a counter E. M. F. The effect of these E. M. Fs. on the regulation or "drop" in the transformer is evidently dependent on the phase differences between the E. M. Fs and currents, or more generally on the power factor of the load. The difficulty in estimating the regulation with a variation of the character of the load has been due to the fact that there are two separate E. M. Fs. of self induction to be taken into account.

The first object of this paper was to show from a study of the vector diagram of the transformer, that in their effect on regulation these two E. M. Fs. are practically in unison, and that if this sum or joint effect can be either measured or calculated, the diagrams and tables for estimating the drop in circuits containing only resistance and self induction may be used for figuring the regulation of transformers; the joint effect referred to is generally known as the "Inductive E. M. F." Next, a graphical proof is given showing that if the secondary be short circuited the E. M. F., which must be impressed on the primary in order to cause the full load current to flow, is the resultant of the ohmic and inductive E. M. Fs.; since these are always combined in the 90° relation this gives a means of measuring the inductive E. M. F.

In the latter half of the paper is developed a formula for calculating the inductive E. M. F. from the dimensions of the transformer; this formula is applied to several arrangements and sub-divisions of the coils in the same transformer and the following rule deduced:

If the secondary is in half as many parts as the primary and each part is between two primary parts, the inductive E. M. F. varies inversely as the square of the number of parts into which the primary is divided. If the primary and secondary are divided into the same number of parts and they are placed alternately, the inductive E. M. F. is decreased with increasing subdivision approximately, but not exactly, with the inverse square of the number of subdivisions of either coil.

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The following list enumerates publications in the department of Physics by those who are now or who have been members of the University. It is printed for the information of their colleagues and friends and is not supposed to be complete. The latest previous list is given in Circular No. 140, p. 60, June, 1899.

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—— A brief history of Wireless Telegraphy. (*The New Pedagogue, July,* 1900.)

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TERRESTRIAL MAGNETISM AND ATMOSPHERIC ELECTRICITY.

An International Quarterly Journal

CONDUCTED BY

L. A. BAUER, Ph. D.,

Lecturer in Terrestrial Magnetism, Johns Hopkins University; Coast and Geodetic Survey, Washington, D. C.

With the Co-operation of Eminent Magneticians.

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PROCEEDINGS OF SOCIETIES.

Scientific Association.

Friday, March 9, 1900, *at* 8 *P. M.*—Special Meeting held in McCoy Hall.

A public address was delivered by Mr. Frederick E. Ives, of Philadelphia, his "three colour system of Colour Photography."

March 22.—One hundred and fiftieth regular meeting.

The paper presented to the Association was "The Meaning of Science." by P W. K. Brooks.

April 26.—One hundred and fifty-first regular meeting. The President, Prof. Rems in the chair.

Dr. W. S. Thayer reported on "Recent Investigations concerning the Aetiolog Malarial Fever."

Philological Association.

March 16, 1900.—One hundred and eighty-first regular meeting. Prof. Bloomfi in the chair. Twenty-five members were present.

Papers read:

Secondary Accent in Anglo-Saxon, Determined by Metrical Criteria, by J. Huguk

Concatenation in the Rig-Veda, by J. A. Ness.

April 27.—One hundred and eighty-second regular meeting. Prof. Gildersleevi the chair. Thirty-four members were present.

Papers read:

Sources of Les Précieuses Ridicules, by J. D. Batchelder.

Milton's Conception of the Temptation as Portrayed in Paradise Regained, by B Miller.

May 18.—One hundred and eighty-third regular meeting. Prof. Gildersleevi the chair. Twenty-seven members were present.

Papers read:

The Auxiliary Use of Venire with the Past Participle in Italian, by J. E. Shaw.

Concerning Grammatical Ictus in English Verse, by J. W. Bright.

Historical and Political Science Association.

March 16.—The Organization and Methods of the Twelfth Census, by W. F. Will

March 16.—

Legal Status of Slaves in Virginia, by J. C. Ballagh.
The Associate-Congregational Church in Baltimore, by J. M. Vincent.
Giddings' Democracy and Empire, by R. J. Mulford.
Baden-Powell's Village Communities in India, by V. E. Smith.
W. Brown's New Democracy, by E. C. Johnson.
Ten Brink's Robespierre and the Red Terror, by B. Kilby.

April 6.—

Internal Improvements in North Carolina, by C. C. Weaver.
Travels in Jamaica, by H. B. Adams.
Ely's Trusts and Monopolies, by G. Cator.
Donaldson's Five Great Oxford Leaders, by J. W. Harry.
Meigs' Growth of the Constitution, by H. S. Hanna.
Gorren's Anglo-Saxons and Others, by W. E. Martin.

April 20.—

The Life of Thomas Holliday Hicks, by G. L. Radcliffe.
Hart's S. S. Chase, by R. J. Mulford.
Coubertin's France since 1814, by I. A. Thorson.
Ingram's History of Religion, by C. E. Johnson.
Adams' C. F. Adams, by V. E. Smith.

May 11.—

Aboriginal Jamaica, by J. E. Duerden.
Australian Federation, by R. J. Mulford.
Russia and the Far Eastern Question, by B. Kilby.
Recent Works on Cromwell, by V. E. Smith.
England's Policy with the Jamaica Negroes, by H. B. Adams.

May 25.—

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In Memoriam.

PROFESSOR THOMAS CRAIG.

s **Craig**, Ph. D., Professor of Pure Mathematics in this Uni-
lied in Baltimore, May 8, 1900. Professor Craig was born in
Pa., in 1856. He was graduated from Lafayette College in 1875,
red this University in 1876. He held a fellowship from 1876 to
eived the degree of Doctor of Philosophy in 1878, and has since
positions of instructor, associate, associate professor, and professor
e was for a brief period connected with the U. S. Coast Survey.
any years he was associated with the *American Journal of Mathe-*
a contributor and as assistant editor, and from 1894 to 1899 he
esponsible editor of the journal.

neeting of the Board of University Studies, held May 23, 1900,
ving minute was unanimously adopted:

members of the Board of University Studies of the Johns Hopkins
ty desire to express their sorrow at the death of their friend and
, Professor Thômas Craig, who, as student and teacher of mathe-
iad been connected with the University for nearly the entire
f its existence. One of the brilliant young men whom Professor
attracted to the University in its early days, he won straightway
rable notice of that eminent man for the enthusiasm and intel-
icumen with which he entered upon the study of advanced
itics, then almost an unknown science in this country; and this
combination of interest, energy, and ability characterized his
reer. At the time of his death he was occupied in the prepara-
treatise on the Theory of Surfaces. Undoubtedly the intense
th which he engaged in this work contributed in large measure
impairment of the nervous system from which he had recently

Professor Craig possessed great power of research, and wrote
r various mathematical journals. For many years he was editor
merican Journal of Mathematics, and it is largely due to his zeal
direction that that Journal continues to hold its high rank in the
itical world. Professor Craig occupied a place in the very front
American mathematicians. His scientific ideals were the highest,
eacher, editor, and investigator, he brought to his work a high
f originality, and an intellectual ardor which was a source of
on to all with whom he was closely associated."

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a	from	wave	length	3000 to 3330	f	from	wave	length	4850 to 5350
b	"	"	"	3270 to 3730	g	"	"	"	5250 to 5750
c	"	"	"	3670 to 4130	h	"	"	"	5650 to 6150
d	"	"	"	4050 to 4550	i	"	"	"	6050 to 6550
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Five hours weekly, through the year. Professor Ames and Dr. Bliss.

This course presupposes at least one year's previous work in physics, and an accurate knowledge of analytic geometry of two dimensions and the calculus. It will be in the main a continuation and extension of the First Year Course, special attention being given to the description and discussion of the experiments on which the science of Physics rests.

The laboratory work of both courses accompanies the lectures throughout the year, and is largely quantitative, being designed to impress the principles of the subject and to impart experimental skill. In the second year, therefore, problems presenting greater difficulties, either experimental or theoretical, are assigned. Written reports of the work are required of all the students.

CHEMISTRY.

The courses in Chemistry are intended to meet the wants (1) of graduate students who make Chemistry their specialty, or who select it as one of their subordinate subjects for the degree of Doctor of Philosophy; and (2) of undergraduate students, who study Chemistry for general training, or as a preliminary to the study of medicine. The first and second years' courses cover the ground of General Chemistry, as far as it is possible to do so in the time occupied. Together they form the full course designed for undergraduates. Graduates, including those who intend to enter the Medical School, who have not done an equivalent amount of work, will follow such parts of these courses as may seem desirable.

Advanced Work for Graduate Students.

Laboratory.

[illegible]irection of Professors Remsen and Morse and Asso- [illegible]Jones. *Daily, except Saturday, from 9 a.m. to 5 p.m.*

The work will consist in a thorough study of analytic methods in making typical preparations especially of compounds of carbon, in practice in the methods of physical chemistry, and in carrying on investigations.

Lectures.

(*a*) Compounds of Carbon, by Professor Remsen. *Five times weekly, through the year.*

(*b*) Historical Topics, under the direction of Professor Remsen, by advanced students. *About twelve lectures, second half-year.*

This work, while serving to familiarize students with chemical literature, is intended to aid them in acquiring the art of presenting subjects in the form of lectures before audiences. All those who intend to become teachers of Chemistry, are expected to take active part in the work.

(*c*) Physical Chemistry, by Associate Professor Jones. *Three times weekly, through the year.*

(*d*) The Elements of Physical Chemistry, by Associate Professor Jones. *Twice weekly, first-half year.*

Journal Meetings.—The instructors and advanced students will meet weekly, on Mondays at 9 a. m., and at such other hours as may be appointed, for the purpose of hearing reports on the principal articles contained in the journals of Chemistry.

The journals read and regularly reported on are: Annalen der Chemie, Berichte der deutschen chemischen Gesellschaft, Journal of the Chemical Society (London), Journal für praktische Chemie, Zeitschrift für analytische Chemie, Zeitschrift für physikalische Chemie, American Chemical Journal, Journal of the Society of Chemical Industry, Bulletin de la Société chimique, Annales de Chimie et de Physique, Zeitschrift für anorganische Chemie, and occasionally others.

Collegiate Courses.

Minor Course.

(*a*) Introduction to General Chemistry.

Lectures and recitations, four hours weekly, through the year, by Professor Renouf and Dr. Gilpin.

(*b*) Laboratory Work.

Five to six hours weekly, through the year, under the direction of Professor Renouf and Dr. Gilpin.

No previous knowledge of Chemistry is required. The class-room work is based on Remsen's Chemistry (Briefer Course), and covers the field of inorganic chemistry, as far as possible. The last twenty class-room exercises give a sketch of organic chemistry, particularly for the benefit of those students whose study of chemistry is confined to the minor course. In the laboratory the student repeats the experiments performed in the class room and, in addition, has some practice in simple qualitative and quantitative analysis. Each student is required to keep a note-book of his work.

Major Course.

(*a*) Advanced Inorganic Chemistry.

Lectures and recitations, four hours weekly, until Christmas, by Professor Morse.

(*b*) Chemistry of the Compounds of Carbon.

Lectures and recitations, four hours weekly, from January 2 to the end of the year, by Professor Morse.

(*c*) Laboratory Work.

Five to six hours weekly, through the year, under the direction of Professor Renouf.

The class-room work in inorganic chemistry, in the major course, is confined to a study of the metallic elements and to analytical chemistry. The laboratory work until January is systematic qualitative analysis; from January to the end of the year, the making of inorganic and organic preparations. The compounds to be made are so chosen that the student may become acquainted with as many classes and methods as possible. The text-books used are Remsen's Inorganic Chemistry (advanced course), Remsen's Organic Chemistry, and Renouf's Inorganic Preparations.

GEOLOGY.

The instruction in Geology is under the direction of Dr. WM. BULLOCK CLARK, Professor of Organic Geology, assisted by Dr. HARRY FIELDING REID, Associate Professor of Geological Physics, Dr. EDWARD B. MATHEWS, Associate Professor of Mineralogy and Petrography, Dr. GEORGE B. SHATTUCK, Associate in Physiographic Geology, and Dr. OLIVER L. FASSIG, Instructor in Meteorology.

An important course of lectures will be given by Mr. BAILEY WILLIS, of the United States Geological Survey, Lecturer on Stratigraphic and Structural Geology, and briefer courses by Professor CLEVELAND ABBE, of the United States Weather Bureau, Lecturer on Meteorology, and Dr. L. A. BAUER, of the United States Coast and Geodetic Survey, Lecturer on Terrestrial Magnetism.

Courses are offered to both graduates and undergraduates. In the case of graduate students, the work is arranged to meet the wants (1) of those who desire to make Geology their principal subject for the degree of Doctor of Philosophy, and (2) of those who wish to select certain courses in Geology for one or both of their subordinate subjects, the major subject being taken in another department. Special arrangements may also be made by graduate students whose time is limited, or who desire to devote their attention to particular courses without reference to a degree.

In the case of undergraduate students, Geology may be taken either as one of the major or as one of the minor courses for the degree of Bachelor of Arts.

The courses in Geology consist of lectures, laboratory and field work, and conferences upon topics of current literature. Great importance is attached to laboratory training as a part of the geological course, and facilities are given for daily work from 9 a. m. to 5 p. m.

LECTURE COURSES.

1. General Geology, by Professor Clark and Dr. Shattuck. *Four times weekly.*
2. Paleontology, by Professor Clark. *Twice weekly.*
3. Historical Geology, by Professor Clark. *Twice weekly.*
4. Experimental Geology, by Associate Professor Reid. *Twice weekly, first half-year.*
5. Geological Physics, by Associate Professor Reid. *Twice weekly, second half-year.*
6. Exploratory Surveying, by Associate Professor Reid. *Twice weekly, for one-third year.*
7. General Mineralogy, by Associate Professor Mathews. *Four times weekly.*
8. Advanced Mineralogy, by Associate Professor Mathews. *Three times weekly.*
9. Petrography, by Associate Professor Mathews. *Three times weekly.*
10. Physiographic Geology, by Dr. Shattuck. *Weekly.*
11. Climatology, by Dr. Fassig. *Twice weekly, for one-third year.*
12. Stratigraphic and Structural Geology, by Mr. Willis. *Twice weekly, for one-third year.*
13. Meteorology, by Professor Abbe.
14. Terrestrial Magnetism, by Dr. Bauer.

LABORATORY WORK.

Laboratory courses are arranged to accompany the lectures, while advanced or special students will be given the opportunity to carry on fuller investigations upon either described or new materials.

CONFERENCES AND STUDENT LECTURES.

In order that the advanced students may be kept in touch with the most recent investigations in the science, conferences are held at which the leading journals in geology are reviewed by the students under the direction of the instructors. The conferences take place bi-weekly.

In order that the advanced students may also have the experience necessary for the successful preparation and delivery of class-room lectures, a course upon some phase of geology is arranged, a special topic being assigned to each student. The lectures take place bi-weekly, alternating with the conferences.

FIELD WORK.

The area of the State of Maryland includes, notwithstanding its comparatively small size, a remarkable sequence of geological formations. The ancient rocks of the earth's crust, as well as those still in the process of deposition, are found, while between these wide limits there is hardly a geological epoch which is not represented. As a result, most excellent facilities are afforded for a study of the various geological horizons.

GEOLOGICAL CAMP.

Arrangements are made annually for a geological encampment of several weeks after the close of the class-room lectures at the University.

GEOLOGICAL LABORATORY AND LIBRARY.

The Geological Laboratory is situated in Hopkins Hall, and comprises over thirty rooms, large and small. Here are placed the library, apparatus and collections, which are accessible to the student daily, from 9 a. m. to 5 p. m.

In accordance with the custom of the University, those books relating to the work of the geological department are given into its charge, the books of general reference being retained in the University Library.

The library of the geological department contains a good representation of the leading journals and works of reference upon geological subjects. It is greatly enriched by the Williams, Lewis and Abbe libraries. Extensive series of topographical and geological maps likewise form a portion of the library, and these are constantly increasing in number.

APPARATUS AND COLLECTIONS.

The collections of the department consist primarily of a large amount of important material brought together from Maryland and adjacent States. It represents all the horizons of the State, being especially rich in crystalline rocks, and in Cretaceous and Tertiary fossils. Some of this material has been already described, while much awaits further study.

Among the most important of the special collections are:

The Williams collection of rocks and minerals, the Lewis collection of rocks and thin sections, the Krantz collection of fossils, the Hill collection of rocks and characteristic fossils from the Cretaceous formations of Texas, and the Stürtz, the Lehmann, and the Allen collections.

State Scientific Bureaus Connected with the Geological Department.

Two scientific bureaus, established by the Legislature and maintained at the expense of the State, are carried on in connection with the geological department. They are the Maryland Geological and Economic Survey and the Maryland State Weather Service. Professor Clark is in charge of both of these organizations, which are concerned with a study of the geology and physical features of the State of Maryland. A sum of $27,000 annually is appropriated by the State for these bureaus.

THE BIOLOGICAL SCIENCES.

The courses in the Biological Sciences are designed (1) for students who wish to make Zoology, Botany, Animal Physiology, Anatomy, or Pathology a subject of advanced study and research, or the principal or a subordinate subject for the degree of Doctor of Philosophy; (2) for graduates in medicine who desire special courses in one or more of these subjects; (3) for undergraduates who desire some knowledge of the biological sciences as part of a liberal education; and (4) for undergraduates who desire to prepare themselves for the study of medicine.

The various laboratories are open daily during the session from 9 a. m. to 5 p. m. The work is conducted under the direction of the professors in the different departments.

Graduate Courses.

ZOOLOGY AND BOTANY.

The work in Zoology and Botany is directed by Dr. W. K. Brooks, Professor of Zoology, assisted by Dr. E. A. Andrews, Associate Professor of Biology, Dr. D. S. Johnson, Associate in Botany, Dr. B. W. Barton, Lecturer in systematic Botany, and other assistants.

1. Professor Brooks will conduct the following courses, with the assistance of Dr. Andrews and Dr. Johnson.

   Advanced laboratory work in Zoology.
   Daily, throughout the year.

   History of Zoology.
   Weekly, from January to the end of the year.

   Zoological Journal Club.
   Weekly, until April 1, for the discussion of the current literature of Zoology.

   Zoological Seminary.
   Weekly, from the beginning of the session, until April 1.

2. Dr. Andrews will give a course of twelve lectures on Protoplasm, in November and December.

3. Dr. Johnson will conduct the following courses:

   The Comparative Morphology of the Vegetable Kingdom.
   Two lectures and two laboratory exercises weekly, throughout the year.

   Physiology and Histology of Plants.
   Two exercises a week, throughout the year.

   Botanical Journal Club.
   Weekly, throughout the year.

   Botanical Seminary.
   Weekly, throughout the year.

PHYSIOLOGY.

The following courses in Physiology are offered to students:

1. By Professor Howell:

   Work leading to the degree of Doctor of Philosop Physiology as the principal subject.

   This work includes lectures, laboratory methods, resea attendance upon the meetings of the physiological semi journal club.

2. By Professor Howell and Dr. Dreyer:

   Work leading to the degree of Doctor of Philosop Physiology as a subordinate subject. Two courses are either of which will be accepted as absolving the conditi subordinate subject. Either course may be taken by students, without reference to a degree.

   (*a*) The course given to medical students, consisting three lectures weekly throughout the year, and laborato six hours weekly, from October to January. This cours in the mornings.

   (*b*) An afternoon course consisting of lectures and la work, three afternoons weekly, from January to June.

3. By Professor Howell:

   Physiological Journal Club.
   Weekly, throughout the year.

4. By Professor Howell:

   Physiological Seminary.
   Weekly, throughout the year.

   Special lectures on selected topics in Physiology, by members or advanced students, are given occasionally as part of the Semi

5. By Professor Howell and Dr. Dreyer:

   Advanced laboratory work in Physiology, methods stration and research.

   This course is intended for those who have completed elements in Physiology. The work is done individually.

ANATOMY.

The various courses given in the department of Ana open to graduate students. In addition, opportun afforded for advanced work and original investiga general outline of the work of the department follows:

I. Systematic instruction in histology, microscopic and neurology by Dr. Bardeen, Dr. Knower, and Dr from October 1 to March 15, mornings.

II. Systematic instruction in gross human anatomy by Mall and Dr. Harrison, from October 1 to March 15, a

III. Advanced work and original investigation u direction of Professor Mall, Professor Harrison, and Dr. daily, during the academic year.

Note.—A more detailed description of the work outlined ab found in the Announcement of the Johns Hopkins Medical Sch

PATHOLOGY.

The courses in Pathology are designed primarily for of medicine. Those in Bacteriology or those in General P Pathological Histology, and Pathological Anatomy are as a subordinate subject for the degree of Doctor of Ph

GREEK.

Greek Seminary.

Professor GILDERSLEEVE will conduct the Greek Seminary, the plan of which is based on the continuous study of some leading author or some special department of literature.

The Seminary consists of the Director, Fellows, and Scholars, and such advanced students as shall satisfy the Director of their fitness for an active participation in the work by an essay, a critical exercise, or some similar test of attainments and capacity. All graduate students however, may have the privilege of attending the course.

During the next academic year the study of The Attic Orators will constitute the chief occupation of the members. There will be two meetings a week during the entire session. Especial attention will be paid to the development of language and style and to the antique canons of aesthetic criticism. The rhetorical works of Dionysios of Halikarnassos will be studied in connection with this course.

The student should possess the text of the orators (Teubner ed.), and the rhetorical works of Dionysios of Halikarnassos, the first volume of which has been edited by Usener and Radermacher. Blass's *Geschichte der Attischen Beredsamkeit* is an important auxiliary, Volkmann's *Rhetorik* will be found serviceable, and Jebb's *Selections from the Attic Orators* may be recommended as an introduction to the study. The various editions of select speeches of Demosthenes by Sandys are also helpful.

Advanced and Graduate Courses.

1. Professor Gildersleeve will also conduct a course of Practical Exercises in Greek, consisting chiefly in translation at dictation from Greek into English and English into Greek, two meetings a week, from the beginning of the session to the first of January.

2. He will lecture on Greek Elegiac and Iambic Poetry, with illustrative readings, once a week after January 1.

3. He will also lecture on select chapters of Greek Syntax in its relation to style.

4. Associate Professor Miller will conduct readings auxiliary to the main study of the graduate students in Greek, twice a week throughout the session.

Notice of other courses is reserved.

Undergraduate Courses.

For Candidates for Matriculation.

Homer, *Iliad* (book VI); Herodotus (book VII); Sight Reading; Prose Composition.

Three hours weekly, through the year. Associate Professor MILLER.

Minor Course.

Lysias, VII, XII.

Three hours weekly, first half-year. Associate Professor SPIEKER.

Private Reading: Xenophon, *Hellenica* (book I).

Plato, *Apology;* Euripides (one play).

Three hours weekly, second half-year. Associate Professor SPIEKER.

Private Reading: Homer, *Odyssey* (books I, IX, X).

Prose Composition.

Weekly, through the year. Associate Professor SPIEKER.

Major Course.

Demosthenes, *Oratio in Leptinem.*

Three hours weekly, first half-year. Associate Professor SPIEKER.

Private Reading: Æschylus, *Prometheus.*

Selections from the elegiac, melic, and iambic poets; Sophocles (one play).

Three hours weekly, second half-year. Associate Professor SPIEKER.

Private Reading: Aristophanes (one play).

Prose Composition.

Weekly, through the year. Associate Professor SPIEKER.

Elective Course.

Justin Martyr.

Two hours weekly, first half-year. Associate Professor SPIEKER.

LATIN.

Latin Seminary.

Associate Professor KIRBY FLOWER SMITH will conduct the Latin Seminary, the plan of which is similar to that followed in Greek. The department of literature to which it is proposed to devote especial attention during the next academic year, is the Latin Historians, and the centre of this work will be Livy and Tacitus. Two meetings a week throughout the year will be devoted to the critical interpretation of these authors, to various auxiliary studies, and to the reading of papers prepared by members of the Seminary.

It is advisable for students to read in advance as much as possible of Livy and Tacitus, and to provide themselves with complete texts of Cæsar (Kübler, Teubner, Leipzig, 1895), Livy (Weissenborn-Müller, Teubner), Tacitus (Halm, 4th edition, Teubner), the "Historicorum Romanorum Fragmenta," edited by Peter (Teubner, 1883), Sallust (Jordan, Weidmann, Berlin, 1887), and Catullus, Tibullus, and Propertius (Haupt-Vahlen, 5th edition, Leipzig, Hirzel, 1885.

Advanced and Graduate Courses.

1. During the first half-year, Dr. Smith will lecture once a week on the Roman Historians, beginning with the earliest period.

2. Throughout the year he will lecture once a week on the Roman Elegy and Epigram.

3. He will also conduct a Journal Club, which will meet regularly to report and discuss recent publications in the field of Classical Philology.

4. Dr. H. L. WILSON will lecture once a week during the first half-year on Latin Epigraphy.

5. Once a week during the second half-year he will conduct a course in the interpretation of Latin Inscriptions.

6. During the second half-year Dr. SUTPHEN will lecture once a week on the *Sermo Cotidianus.*

7. He will also conduct a class, for advanced students, in the rapid reading of the Latin Historians.

The schedule given above is subject to additions and modifications.

Undergraduate Courses.

For Candidates for Matriculation.

Cicero, *De Senectute*; Sallust, *Catiline.*

Two hours weekly, first half-year. Dr. SUTPHEN.

Ovid, *Heroides*; Vergil, *Eclogues.*

Two hours weekly, second half-year. Dr. SUTPHEN.

B. Linguistic Science and Comparative Grammar of the Indo-European Languages.

6. The Elements of Linguistic Science, with an introductory account of the Ethnology of the Indo-European peoples.
Weekly, through the year.

7. Comparative Grammar of Greek, Latin, German and Sanskrit: The history of Indo-European noun-formation.
Weekly, through the year.

8. Introduction to the Lithuanian language and literature.
Weekly, through the year.

No knowledge of Sanskrit is required for any of the courses under B. Course 6 sketches briefly the history of the science of language; presents a concise account of the ethnological history of the Indo-European (Aryan) peoples; deals with the fundamental question of growth and change in language; and finally treats of the origin of language. Course 7 is intended as an introduction into the most elementary methods and results of the comparative grammar of the more important Indo-European languages. Course 8 is recommended especially to students of the Teutonic languages.

ENGLISH.

A.

Professor Bright will conduct the following courses:

I.

English Seminary.

Graduate students are admitted to the Seminary as soon as they have satisfied initial requirements for independent research. The discipline of the Seminary is designed to impart training in scholarly methods of dealing with literary and linguistic problems. Study and investigation are bestowed upon selected periods of literary history, upon departments of literature extending through successive periods, and upon the works of important writers, separately or in groups. Usually there is a change of subject each half-year.

During the academic year beginning October 1, 1900, the Seminary will be engaged in the study of the Literature of the Fourteenth Century.

The meetings of the Seminary will occupy four hours a week. *Tuesdays and Thursdays, 3–5 p. m.*

II.

Lectures on Anglo-Saxon and Middle English Grammar. *Thursday* 12 *m., first half-year*; *Wednesday,* 4 *p. m., second half-year.*

The principal works to be studied in connection with these lectures are: F. Kluge, *Geschichte der englischen Sprache,* Strassburg, Trübner, 1899; Ferd. Dieter, *Laut- und Formenlehre der altgermanischen Dialekte,* Leipzig, Reisland, 1898; Max Kaluza, *Historische Grammatik der englischen Sprache,* Berlin, Felber, 1900; L. Morsbach, *Mittelenglische Grammatik,* Halle, Niemeyer, 1896; K. Luick, *Untersuchungen zur englischen Lautgeschichte,* Strassburg, Trübner, 1896; ten Brink und Kluge, *Chaucers Sprache und Verskunst,* Leipzig, Tauchnitz, 1899.

III.

The Interpretation of Texts: (*a*) The Anglo-Saxon version of Bede's *Ecclesiastical History of England. Monday,* 11 *a. m., first half-year*; (*b*) The Anglo-Saxon poem *Guthlac. Monday and Tuesday,* 12 *m., second half-year.*

Students will be required to provide themselves witl
edition of Bede (*Bibliothek der angelsächischen Pros*
Leipzig, Wigand, 1897–9).

IV.

The English Journal Club (*fortnightly, two hours*)
on the current journals, reviews of new books, and t
tion and discussion of original papers on linguistic
subjects.

V.

An introductory course in Anglo-Saxon, with Bri
Saxon Reader as the text-book. *Monday and Wedn*

B.

Professor Browne will give the following courses
Literature:

VI.

A general course covering the whole field, from th
19th century. The study, of course, is synoptical; b
is laid upon the chief writers and most importa
Arnold's Manual of English Literature is used as
Wednesday and Thursday, 1 *p. m.*

VII.

A course in the writers of the 12th, 13th, and 14
(from the Peterborougn Chronicle to Chaucer). T
read from Morris and Skeat's *Specimens,* the student
with the easier and proceeding to the more difficult.
to the knowledge thus acquired of an interesting an
period of our literature, this introduction to the ea
the language will be found a helpful prodromus to
Anglo-Saxon. *Monday and Tuesday,* 1 *p. m.*

VIII.

A course in the writers of the Elizabethan period.
and development of the English drama will be trac
earliest recorded beginnings down to Shakespeare, the
tive of its highest perfection, and in its decadence i
Jacobean dramatists. *Tuesday,* 12 *m., first half-year.*

IX.

A course in the literature of the eighteenth centur
12 *m., second half-year.*

X.

The Early Scottish Poetry from Barbour (A. D. 135
say (A. D. 1550) will be studied by the aid of a c
especially prepared for this class. A course of his
critical lectures will be given concurrently with t
Friday, 12 *m.*

XI.

Lectures for advanced students on the Transfo
English Prose, and on another subject to be anno
Wednesday, 11 *a. m.*

C.

Professor Greene will give the following courses i
and in English Literature:

XII.

Rhetoric and English Composition. Theory, based
books, lectures, and discussions; critical study of pr

tary *German*; Brandt, *German Reader*; von Moser, *ibliothekar*; von Wildenbruch, *Das edle Blut*; Goethe, *t*; Prose Composition (E. S. Buchheim, *Elementary n Prose Composition*, Oxford, 1893); Whitney, *German mar*.

rs weekly, through the year.

ourse B is intended only for students who have matriculated in l have fully met *at entrance* the matriculation requirements; for ents, it absolves the requirements in German. Other students lve Minor A.

Major Course.

e, *Faust*. Professor Wood. Schiller, *Wallensteins Lager*, *Die Picco-* Mr. Hofmann.

hours weekly, through the year.

ry of German Literature: Classical Period.

ekly, through the year. Associate Professor Vos.

e Composition.

A. Buchheim, *Materials for German Prose Composition*, Parts I and II, don, 1894.

Veekly, through the year. Professor Wood and Mr. Hofmann.

ivate Reading: Schiller, *Wallensteins Tod*.

Elective Course.

ontemporary Literature, in Rapid Readings.

Works by Hauptmann, Sudermann, Ebner-Eschenbach, and von Wildenruch are read

Two hours weekly, through the year.

This course is intended for students who have completed the equivalent of a Minor.

Special Courses.

Courses 1 and 2 are open to graduate students who already possess an elementary knowledge of German and wish to acquire greater fluency in reading. The first is intended for students in Languages, History, and Economics; the second, for students in the Natural Sciences. Successful completion of either course is accepted as an equivalent of the reading knowledge of German required of candidates for the degree of Doctor of Philosophy.

1. Historical German.

Seiler, *Die Heimat der Indogermanen*; Hoffmann's *Historische Erzählungen*; Lange, *Athen im Spiegel der aristophanischen Komödie.*

Twice weekly.

2. Scientific German.

Dippold, *Scientific German Reader*; von Helmholtz, *Über Goethe's naturwissenschaftliche Arbeiten*; Cohn, *Über Bakterien.*

Twice weekly.

This course is open also to undergraduate students who have completed the equivalent of a Minor in German.

3. Oral Exercises in German.

Twice weekly. Mr. Hofmann.

This course is intended especially for students in the departments of modern languages, who lack an extended vocabulary and sufficient familiarity with written and spoken German. A thorough knowledge of the elements is presupposed.

Advanced Courses.

I. With second- and third-year students:

Professor Elliott.

(*a*). Seminary. *Twice weekly.*
The Fables of Marie de France; Work on Manuscripts.

(*b*). French Dialects. *Weekly.*

(*c*). Lectures on Dante. *Weekly.*

(*d*). Romance Club. *Weekly.*

Professor F. M. Warren.

(*e*). French Lyric Poetry in the Middle Ages. *Twenty lectures in January and February.*

(*f*). The Romantic School. *Six public lectures.*
[I. J. J. Rousseau and his influence. II. Châteaubriand, Mme. de Staël. III. Nodier, Lamartine. IV. Victor Hugo. V. De Vigny, De Musset. VI. George Sand, A. Dumas père.]

Dr. Hugo P. Thieme.

(*g*). French Versification. *Twelve lectures.*

Associate Professor Marden.

(*h*). Spanish Seminary. *Twice weekly.*
The *Poema de Fernan Gonsales.* Construction of a critical text based on the Escurial manuscript and several unpublished fragments of the poem.

(*i*). Spanish Philology. *Twice weekly.*
Gorra, *Lingua e Letteratura Spagnuola delle Origini*, Milan, 1898; Baist, *Die Spanische Sprache* (in Gröber's *Grundriss der Romanischen Philologie*, Vol. I, Strassburg, 1888); Meyer-Lübke, *Grammaire des Langues Romanes*, Vols. I, II, Paris, 1890, 1895.

Dr. Brush.

(*j*). Old French Readings. *Class A. Two hours weekly.* With occasional lectures on the manners and customs of the Middle Ages: 1. Château Life; 2. The Tourney; 3. Hunting and Falconry.

First Semester: Early French Lyrics.

Texts:—*Romanzen u. Pastourellen*, Bartsch, Leipzig, 1870; *Les Plus Anciens Chansonniers Français*, Brakelmann, Paris, 1891, and continuation, Marburg, 1896.

Second Semester: The Romans d'Aventure.

Texts:—*Roman de la Rose ou de Guillaume de Dole*, Servois, Société des Anciens Textes Français, Paris, 1893; Gautier d'Arras: *Ille et Galeron*, Foerster, Romanische Bibliothek, Vol. VII, Halle, 1891; *L'Escoufle*, Michelant et Meyer, Société des Anciens Textes Français, Paris, 1894; *Le Chevalier à l'Épée*, Armstrong, Baltimore, 1900; also Jean de Meung and Guillaume de Lorris = *Le Roman de la Rose*, Michel, Paris, 1872.

This course will be adapted to students of the English Seminary who are studying fourteenth century literature.

II. With first-year students:

Professor Elliott.

(*a*). Popular Latin. *Weekly.*

(*b*). French Physiological Phonetics. *Weekly.*
Passy, *Les sons du français*; Beyer, *Französische Phonetik*; Sweet, *Primer of Phonetics*; Vietor, *Elemente der Phonetik*; Michaelis and Passy, *Dictionnaire Phonétique de la Langue Française.*

Commercial Courses.

Spanish: *Conversation.* Adapted for beginners and open also to persons not connected with the University. *Twice weekly.* Mr. Gould.

Text:—Ybarra: *Practical Method in Spanish*, Boston (Heath & Co.)

Spanish: *Commercial Course.* Adapted for beginners and open also to persons not connected with the University. *Twice weekly.* Mr. Gould.

Text:—Garner's *Short Spanish Grammar*, New York (Amer. Book Co.)

HISTORY, POLITICS, AND ECONOMICS.

History.

Professor Herbert B. Adams will conduct the following courses:

1. Historical and Political Science Association.
   Alternate Friday evenings. For the staff and graduates only.
2. History of Greek and Roman Politics.
   Two hours weekly, through the year. For graduates.
3. Educational History and Class Conference.
   One hour weekly, through the year. For graduates.
4. Civilization and Politics in the Far East.
   Two hours weekly, through the year. For undergraduates; open to graduates. [Part of "Major History."]

Associate Professor John Martin Vincent.

1. Historical Research.
   Two hours weekly, first half-year. For graduates.
2. History of Historical Writing.
   Two hours weekly, second half-year. For graduates.
3. Historical Conference for the study of practical problems in historical research.
   Two hours fortnightly, through the year. For graduates.
4. European History.
   Two hours weekly, through the year. [Part of "Major History."]
5. Historical Politics.
   Two hours weekly, through the year. [Part of "History-Economics."]

Dr. Bernard C. Steiner, Associate in History:

American Political and Constitutional History.
Two hours weekly, through the year. For undergraduates; open to graduates. [Part of "Politics Major."]

Dr. J. C. Ballagh, Associate in History.

1. Classical and Early European History.
   Four hours weekly, through the year. For undergraduates. ["History Minor."]
2. Southern History.
   One hour weekly, through the year. For graduates.
3. Oral Examinations in History.
   One hour weekly, through the year. For graduates.

Dr. Guy Carleton Lee, Instructor in History:

1. English Political and Constitutional History.
   Two hours weekly, through the year. For undergraduates. [Part of "Politics Major."]
2. Introduction to the Study of Law.
   One hour weekly, through the year. For graduates and college seniors.
3. Historical Jurisprudence.
   One hour weekly, through the year. Open to graduates and law students only.
4. Public Speaking and Class Debates.
   Six hours weekly, through the year. For undergraduates.

Dr. James Schouler, of Boston, will give a short course lectures in the spring of 1901 on American Histori Biography.

Open to the entire University and the general public.

Politics.

Associate Professor W. W. Willoughby:

1. History of Mediaeval Political Philosophy.
   Two hours weekly, first half-year. For graduates.
2. History of Modern Political Philosophy.
   Two hours weekly, second half-year. For graduates.
3. Constitutional Law of the United States.
   Two hours weekly, through the year. For graduates.
4. Political Conference.
   Two hours fortnightly, devoted to a consideration of the problems colonial government and administration.

Economics.

Associate Professor Sidney Sherwood:

1. Economic Seminary: Commercial Policy of the United State
   Alternate Thursday afternoons. For graduates.
2. The Law of Economic Development.
   One hour weekly, through the year. For graduates.
3. Banking.
   Two hours weekly, first-half year. For graduates.
4. Theory of Credit.
   Two hours weekly, second half-year. For graduates.
5. Advanced Economics.
   Two hours weekly, through the year. Designed for undergraduates; ope to graduates. [Elective.]

Associate Professor J. H. Hollander will be absent on leav during the ensuing academic year for public service a Treasurer of Porto Rico. His class work will be carrie on by the following substitutes:

Mr. W. F. Willoughby, of the U. S. Department of Labor

1. Labor Problems and Labor Legislation.
2. Social Economics.
   One hour weekly, through the year. For graduates.

Dr. E. D. Durand, of Leland Stanford, Jr. University, an of the U. S. Industrial Commission:

American Finance.
Two hours weekly, first half-year. For graduates.

Undergraduate Economics. (Instructor to be announced).

1. Elements of Economics. Money and Banking.
   Two hours weekly, through the year. [Part of "History-Economics."]
2. Economics Minor.
   a. Elements of Economics. Money and Banking.
   b. Industrial Growth of the United States. Commerce, hom and foreign. Taxation.
   Four hours weekly, through the year.

Besides furnishing a general outline of economic science of value to ever citizen, this course is designed especially to aid young men in preparatio for business.

Public Aid, Charity, and Correction.

Dr. J. R. Brackett, President of the Board of Supervisor of Charities, Baltimore, will give class instruction in th following subjects:

1. Public Aid, Charity, and Correction.
   One hour weekly, first half-year. For graduates and specialists.

nferences on Charitable Legislation and Custom in England nd the United States.

hour weekly, second half-year.

PHILOSOPHY.

e undergraduate courses in Philosophy provide five hours eek of work for one year, under the direction of Professor FIN. All candidates for the degree of Bachelor of Arts are red to follow them during the last year of residence.

ductive and Inductive Logic.

logical forms—terms, propositions, syllogisms—are studied as an is or explanation of the thinking process, and as a practical dis- e in exact thought: attention is given also to the material elements rence, as these are stated in the several inductive methods.

ighton's Introductory Logic is used as a text-book, with references to rks of Jevons, Mill, Bain, Keynes, and other writers.

r hours weekly, until Christmas.

ychology.

instruction in psychology is intended to give a general view of the s of the present methods of study, the investigations in regard to the y and intensity of sensations, the duration of psychic acts, etc.—in al, the subjects treated in Part II of Ladd's Physiological Psychology g presented with sufficient detail to render them intelligible and inter-. A series of lectures and demonstrations on the anatomy and physi- of the nervous system is included in the course.

ecial emphasis is laid upon the facts of conscious experience as n through introspection, the most important end to be secured being, elieved, such an understanding of the facts and laws of mental life as fit one for wise self-government and effective influence. With this such powers and states of mind as attention, memory, association, imagination, the feelings, the will, are discussed in as concrete and cal a way as possible. A text book is used as a basis of instruction, is is largely supplemented by informal lectures, and by references to as authorities.

dwin's Elements of Psychology, Sully's Human Mind, James's ology, Höffding's Outlines of Psychology, Dewey's Psychology, lton's Lectures on Metaphysics, Porter's Human Intellect, Spencer's iples of Psychology, Ladd's Outlines of Physiological Psychology, ed as books of reference. One essay on an assigned subject is required each member of the class.

r hours weekly, during January; five hours, from February 1 *to April* 1.

thics.

ics is treated with reference to its fundamental problems as a theoreti- ience, and also from a practical point of view. Its psychological basis various forms of feeling native to our constitution, and in the power tional self-determination; the nature of the sense of obligation; the rity of conscience; the diversities of moral opinion; the historic ies of morals—hedonism, utilitarianism, intuitionism, and the appli- to ethical theory of the doctrine of evolution;—these are some of pics discussed.

wler's Principles of Morals, Part II, is employed as a text-book, but struction is given, to a considerable extent, through lectures. One is required from each member of the class.

e hours weekly, after April 1.

istory of Philosophy.

tline of Greek Philosophy.

ekly, first half-year.

tline of Modern Philosophy. [Optional Course.]

ekly, second half-year.

r next year the following advanced courses in Philosophy ffered:

odern Philosophy from Descartes to Kant.

ekly, through the year. Professor GRIFFIN.

odern Ethical Theories.

rtnightly. Professor GRIFFIN.

JOHNS HOPKINS MEDICAL SCHOOL.

The session begins October 1 and extends to June 15.

The Annual Announcement of the Medical School is now ready and will be sent on application. Announcements of the courses for graduates in medicine will also be sent on application.

STAFF.

Anatomy	F. P. MALL, M. D., Professor.
	R. G. HARRISON, PH. D., M. D., Asso. Professor.
	C. R. BARDEEN, M. D., Associate.
	H. McE. KNOWER, PH. D., Instructor.
	M. T. SUDLER, PH. D., Instructor.
	J. B. MACCALLUM, M. D., Assistant.
	W. H. LEWIS, M. D., Assistant.
Physiology	W. H. HOWELL, PH. D., M. D., Professor.
	G. P. DREYER, PH. D., Associate Professor.
	P. M. DAWSON, M. D., Instructor.
Physiological Chemistry	J. J. ABEL, M. D., Professor.
	WALTER JONES, PH. D., Associate.
Pharmacology and Toxicology	J. J. ABEL, M. D., Professor.
	REID HUNT, PH. D., M. D., Assoc. Professor.
Pathology and Bacteriology	W. H. WELCH, M. D., LL. D., Professor.
	N. MACL. HARRIS, M. B., Associate.
	W. G. MACCALLUM, M. D., Associate.
	E. L. OPIE, M. D., Instructor.
	H. T. MARSHALL, M. D., Assistant.
Medicine	WILLIAM OSLER, M. D., LL. D., Professor.
	W. S. THAYER, M. D., Associate Professor.
	T. B. FUTCHER, M. B., Associate.
	F. R. SMITH, M. D., Instructor.
	H. B. JACOBS, M. D., Instructor.
	T. MCCRAE, M. B., Instructor.
	L. P. HAMBURGER, M. D., Assistant.
	C. P. EMERSON, M. D., Instructor.
Surgery	W. S. HALSTED, M. D., Professor.
	J. M. T. FINNEY, M. D., Associate Professor.
	J. C. BLOODGOOD, M. D., Associate.
	H. W. CUSHING, M. D., Associate.
	H. H. YOUNG, M. D., Instructor.
	W. S. BAER, M. D., Assistant.
Gynecology	H. A. KELLY, M. D., Professor.
	W. W. RUSSELL, M. D., Associate Professor.
	T. S. CULLEN, M. B., Associate Professor.
	OTTO G. RAMSAY, M. D., Associate.
	E. HURDON, M. D., Assistant.
Obstetrics	J. W. WILLIAMS, M. D., Professor.
	G. W. DOBBIN, M. D., Associate.
	F. W. LYNCH, M. D., Assistant.
Psychiatry	H. M. HURD, M. D., LL. D., Professor.
	H. J. BERKLEY, M. D., Clinical Professor.
Pediatrics	W. D. BOOKER, M. D., Clinical Professor.
Neurology	H. M. THOMAS, M. D., Clinical Professor.
	STEWART PATON, M. D., Assistant.
Laryngology and Rhinology	J. N. MACKENZIE, M. D., Clinical Professor.
Ophthalmology and Otology	SAMUEL THEOBALD, M.D., Clinical Professor.
	R. L. RANDOLPH, M. D., Associate.
	H. O. REIK, M. D., Assistant.
Dermatology	J. W. LORD, M. D., Clinical Professor.
	T. C. GILCHRIST, M. D., Clinical Professor.
History and Literature of Medicine.	J. S. BILLINGS, M. D., Lecturer.

DEGREES CONFERRED JUNE 12, 1900.

The public exercises of Commencement were held in the Academy of Music at 4 p. m. Tuesday, June 12, 1900. Degrees were conferred on forty-two bachelors of arts, thirty-three doctors of philosophy, and forty-three doctors of medicine. The honors of the year and the recent appointments were announced (see p. 86). In the absence of President Gilman, Professor Gildersleeve presided and conferred the degrees. An address was made by Professor Osler.

DOCTORS OF PHILOSOPHY.

HOMER VAN VALKENBURG BLACK, of Atlanta, Ga., A. B., University of Georgia, 1896. *Subjects:* Chemistry, Geology, and Mineralogy. *Dissertation:* The Permanganates of Barium, Strontium, and Calcium. *Referees on dissertation:* Professors Remsen and Morse.

WILLIAM MARTIN BLANCHARD, of Hertford, N. C., A. B., Randolph-Macon College, 1894. *Subjects:* Chemistry, Physics, and Geology. *Dissertation:* The Chlorides of Parabromorthosulphobenzoic Acid and some of their Derivatives. *Referees on dissertation:* Professors Remsen and Morse.

HALL CANTER, of Baltimore, A. B., Randolph-Macon College, 1892. *Subjects:* Chemistry, Physiology, and Biology. *Dissertation:* Orthophenylsulphonebenzoic Acid and Related Compounds. *Referees on dissertation:* Professors Remsen and Morse.

CHARLES EDWARD CASPARI, of Baltimore, A. B., Johns Hopkins University, 1896. *Subjects:* Chemistry, Geology, and Mineralogy. *Dissertation:* I. An Investigation of the Fatty Oil contained in the Seeds of *Lindera Benzoin*. II. Lauric Acid and some of its Derivatives. *Referees on dissertation:* Professors Remsen and Morse.

HARDEE CHAMBLISS, of Selma, Ala., Virginia Military Institute, 1894. *Subjects:* Chemistry, Geology, and Physics. *Dissertation:* The Permanganates of Magnesium, Zinc, and Cadmium. *Referees on dissertation:* Professors Remsen and Morse.

WILLIAM SIDNEY DREWRY, of Fayetteville, N. C., A. B., University of Virginia, 1893. *Subjects:* History, Economics, and Politics. *Dissertation:* Slave Insurrections in Virginia (1830–1865). *Referees on dissertation:* Dr. Steiner and Dr. Ballagh.

JAMES EDWIN DUERDEN, of Kingston, Jamaica, Associate, Royal College of Science, London, 1889. *Subjects:* Zoology, Paleontology, and Physiology. *Dissertation:* West-Indian Madreporarian Polyps. *Referees on dissertation:* Professors Brooks and Andrews.

LUTHER PFAHLER EISENHART, of York, Pa., A. B., Pennsylvania College, 1896. *Subjects:* Mathematics, Physics, and Astronomy. *Dissertation:* Infinitesimal Deformation of Surfaces. *Referees on dissertation:* Professors Newcomb and Craig.

HERBERT BALDWIN FOSTER, of Baltimore, A. B., Harvard University, 1895. *Subjects:* Greek, Sanskrit, and Latin. *Dissertation:* On the Significance of the *Deus ex Machina* in the Extant Dramas of Euripides. *Referees on dissertation:* Professors Gildersleeve and Spieker.

WILLIAM LINWOOD FOUSHEE, of Roxboro, N. C., A. M., Wake Forest College, 1894. *Subjects:* Greek, Latin, and Sanskrit. *Dissertation:* The Relation of Plato to Animate Nature. *Referees on dissertation:* Professors Gildersleeve and Spieker.

WIGHTMAN WELLS GARNER, of Darlington, S. C., A. B., South Carolina College, 1896. *Subjects:* Chemistry, Geology, and Physics. *Dissertation:* Action of Aromatic Sulphonchlorides on Urea. *Referees on dissertation:* Professors Remsen and Morse.

CLYDE CHEW GLASCOCK, of Buckland, Va., University of Virginia, 1892. *Subjects:* German, French, and Latin. *Dissertation:* The Preterit Tense of the verb *haben* in Rime-position in Middle High German. *Referees on dissertation:* Professors Wood and Vos.

LAWRENCE EDMONDS GRIFFIN, of Hamline, Minn., A. B. and Ph. B., Hamline University, 1895. *Subjects:* Zoology, Physiology, and Botany. *Dissertation:* The Anatomy of Nautilus Pompilius. *Referees on dissertation:* Professors Brooks and Andrews.

SIVERT N. HAGEN, of Hagan, Minn., A. B., Luther College, 1896. *Subjects:* English, German, and French. *Dissertation:* The Norse Loan-Words in the York Mystery Plays. *Referees on dissertation:* Professors Bright and Browne.

JOSEPH CAWDELL HERRICK, of Virginia, A. B., University of Virginia, 1896. *Subjects:* Physiology, Chemistry, and Physics. *Dissertation:* The Influence of Variation of Temperature upon Nervous Conductivity, studied by the Galvanometric Method. *Referees on dissertation:* Professors Howell and Dreyer.

DAVID WILBUR HORN, of Carlisle, Pa., A. B., Dickinson College, 1897. *Subjects:* Chemistry, Geology, and Physics. *Dissertation:* A Study of the Action of Carbon Dioxide on the Borates of Barium, and of the Action of Acid Borates on the Carbonate of Barium at High Temperatures. *Referees on dissertation:* Professors Remsen and Morse.

WILLIAM BASHFORD HUFF, of Boscobel, Wis., A. B., University of Wisconsin, 1889. *Subjects:* Physics, Chemistry, and Electricity. *Dissertation:* The Spectra of Mercury. *Referees on dissertation:* Professors Rowland and Ames.

JULIAN HUGUENIN, of Charleston, S. C., A. B., Charleston College, 1895. *Subjects:* English, German, and French. *Dissertation:* Secondary Stress in Anglo-Saxon,—determined by Metrical Criteria. *Referees on dissertation:* Professors Bright and Browne.

WALTER HULLIHEN, of Staunton, Va., A. B., University of Virginia, 1896. *Subjects:* Latin, Greek, and German. *Dissertation:* The Use of the Particles *Antequam* and *Priusquam*, with special reference to the Historical Development of their Subjunctive Usage. *Referees on dissertation:* Professors Smith and Spieker.

ROBERT EDMUND HUMPHREYS, of Salem, Va., A. B., Emory and Henry College, 1889. *Subjects:* Chemistry, Geology, and Mineralogy. *Dissertation:* The Action of Phenol on the Chlorides of Orthosulphobenzoic Acid. *Referees on dissertation:* Professors Remsen and Morse.

CHARLES RANALD McINNES, of Vankleek Hill, Ont., A. M., Queen's University (Ont.), 1896. *Subjects:* Mathematics, Physics, and Astronomy. *Dissertation:* Superosculated Sections of Surfaces. *Referees on dissertation.* Professors Newcomb and Craig.

WILLIAM STARR MYERS, of Asheville, N. C., A. B., University of North Carolina, 1897. *Subjects:* History, Economics, and Politics. *Dissertation:* The Maryland Constitution of 1864. *Referees on dissertation:* Professor Adams and Dr. Steiner.

AUSTIN McDOWELL PATTERSON, of Xenia, O., A. B., Princeton University, 1897. *Subjects:* Chemistry, Geology, and Mineralogy. *Dissertation:* The Reduction of Permanganic Acid by Hydrogen and Ethylene and Study of some of its Salts. *Referees on dissertation:* Professors Remsen and Morse.

LOUIS MAXWELL POTTS, of Canonsburg, Pa., A. B., Washington and Jefferson College, 1896. *Subjects:* Physics, Chemistry, and Mathematics. *Dissertation:* Rowland's New Method for measuring Electric Absorption and Energy Losses due to Hysteresis and Foucault Currents, and Detection of Short Circuits in Coils. *Referees on dissertation:* Professors Rowland and Ames.

GEORGE LOVIC PIERCE RADCLIFFE, of Lloyd's, Md., A. B., Johns Hopkins University, 1897. *Subjects:* History, Politics and Economics. *Dissertation:* Governor Thomas H. Hicks, of Maryland, and the Civil War. *Referees on dissertation:* Professor Adams and Dr. Steiner.

ALBERT MOORE REESE, of Baltimore, A. B., Johns Hopkins University, 1892. *Subjects:* Zoology, Paleontology, and Botany. *Dissertation:* Structure and Development of the Thyroid Gland in Petromyzon. *Referees on dissertation:* Professors Brooks and Andrews.

HERBERT MEREDITH REESE, of Baltimore, A. B., Johns Hopkins University, 1897. *Subjects:* Physics, Mathematics, and Physical Chemistry. *Dissertation:* An Investigation of the Zeeman Effect with reference to Cadmium, Zinc, Magnesium, Iron, Nickel, Titanium, Carbon, Calcium, Aluminium, Silicon, and Mercury. *Referees on dissertation:* Professors Rowland and Ames.

WILLIAM ROSENAU, of Baltimore, A. B., University of Cincinnati, 1888. *Subjects:* Hebrew, Arabic, and History of Philosophy. *Dissertation:* Hebraisms in the Authorized Version of the Bible. *Referees on Dissertation:* Professors Haupt and Bright.

RICHARD BURTON ROWE, of Clarksville, N. Y., Ph. B., Union College, 1896. *Subjects:* Geology, Mineralogy, and Biology. *Dissertation:* The Paleodevonian Formations in Maryland: a Study of their Stratigraphy and Faunas. *Referees on dissertation:* Professors Clark and Reid.

JAMES EUSTACE SHAW, of Florence, Italy, A. B., Johns Hopkins University, 1896. *Subjects:* Italian, French, and History. *Dissertation:* History of the Development of the Auxiliary Uses of *Venire* and *Andare* in Italian. *Referees on dissertation:* Professor Elliott and Dr. L. E. Menger.

ERNEST ASHTON SMITH, of Meadville, Pa., A. B., Ohio Wesleyan University, 1888. *Subject:* Economics, History, and Politics. *Dissertation:* History of the Confederate Treasury. *Referees on dissertation:* Professor Sherwood and Dr. Steiner.

ELISHA CHISHOLM WALDEN, of Cincinnati, O., A. B., Ohio Wesleyan University, 1892. *Subjects:* Physiology, Pathology, and Chemistry. *Dissertation:* A Plethysmographic Study of the Conditions during Hypnotic Sleep. *Referees on dissertation:* Professors Howell and Welch.

CHARLES CLINTON WEAVER, of Greensboro, N. C., A. B., Trinity College (N. C.), 1895. *Subjects:* History, Politics, and History of Philosophy. *Dissertation:* Internal Improvements in North Carolina previous to 1860. *Referees on dissertation:* Professor Adams and Dr. Ballagh.

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APPOINTMENTS, PROMOTIONS, AND HONORS ANNOUNCED JUNE 12, 1900.

The following appointments and promotions have recently been made by the Trustees:—

In the Philosophical Faculty:

Frank Mobley, M. A., D. Sc., recently Professor in Haverford College, to be Professor of Mathematics.

Harry C. Jones, Ph. D., now Associate, to be Associate Professor of Physical Chemistry.

John B. Whitehead, A. B., now Instructor, to be Associate in Applied Electricity.

Harry L. Wilson, Ph. D., now Instructor, to be Associate in Latin.

Henry S. West, Ph. D., now Assistant, to be Instructor in English.

J. Eustace Shaw, Ph. D., now Fellow, to be Instructor in Italian.

Edward D. Durand, Ph. D., to be Lecturer in American Finance.

William F. Willoughby, A. B., to be Lecturer in Social Economics.

In the Medical Faculty:

Thomas S. Cullen, M. B., now Associate, to be Associate Professor of Gynecology.

George P. Dreyer, Ph. D., now Associate, to be Associate Professor of Physiology.

Reid Hunt, M. D., Ph. D., now Associate, to be Associate Professor of Pharmacology.

William W. Russell, M. D., now Associate, to be Associate Professor of Gynecology.

Norman MacL. Harris, M. B., now Assistant, to be Associate in Bacteriology.

William G. MacCallum, M. D., now Assistant, to be Associate in Pathology.

Otto G. Ramsay, M. D., now Instructor, to be Associate in Gynecology.

Percy M. Dawson, M. D., now Assistant, to be Instructor in Physiology.

Charles P. Emerson, M. D., to be Instructor in Medicine.

Eugene L. Opie, M. D., now Assistant, to be Instructor in Pathology.

Mervin T. Sudler, Ph. D., now Assistant, to be Instructor in Anatomy.

William S. Baer, M. D., to be Assistant in Orthopaedic Surgery.

Warren H. Lewis, M. D., to be Assistant in Anatomy.

Frank W. Lynch, M. D., to be Assistant in Obstetrics.

John B. MacCallum, M. D., to be Assistant in Anatomy.

Harry T. Marshall, M. D., now Fellow, to be Assistant in Pathology.

Adam T. Bruce Fellows in Biology.

Caswell Grave, of Monrovia, Ind., S. B., Earlham College, 1895, Fellow, Johns Hopkins University, 1898–99, and Ph. D., 1899.

Lawrence Edmonds Griffin, of Hamline, Minn., A. B. and Ph. B., Hamline University, 1895, Fellow, Johns Hopkins University, 1899–1900, and Ph. D., 1900.

William S. Rayner Fellow in Semitic Languages.

Karl Josef Grimm, of Baltimore, Fellow, Johns Hopkins University, 1897–99, and Ph. D., 1899.

Fellows, 1900–1901.

Herbert Thompson Archibald, of Halifax, N. S., A. B., Dalhousie University, 1897. *Greek.*

George Ernest Barnett, of Mocksville, N. C., A. B., Randolph Macon College. 1891. *Economics.*

Frank Ringgold Blake, of Baltimore, A. B., Johns Hopkins University, 1897. *Semitic Languages.*

George Dobbin Brown, of Howard Co., Md., A. B., Johns Hopkins University, 1895. *English.*

Benjamin Palmer Caldwell, of New Orleans, La., A. B., Tulane University, 1893. *Chemistry.*

Howard Vernon Canter, of Cantersburg, Va., A. B., Washington and Lee University, 1896. *Latin.*

Winterton Conway Curtis, of The Dalles, Ore., A. B., Williams College, 1897. *Zoology.*

Joseph Erlanger, of San Francisco, Cal., S. B., University of California, 1895; M. D., Johns Hopkins University, 1899. *Pathology.*

Arthur Henry Ewing, of Ludhiana, India, A. B., Washington and Jefferson College, 1887. *Sanskrit.*

Joseph Christie Whitney Frazer, of Lexington, Ky., S. B., Kentucky State College, 1897. *Chemistry.*

Norman Everett Gilbert, of Middletown, Conn., A. B., Wesleyan University, 1895. *Physics.*

Roscoe Guernsey, of East Cobleskill, N. Y., A. B., Union College, 1896. *Greek.*

Fred Cole Hicks, of Tipton, Iowa, Ph. B., Cornell College, 1896. *German.*

George Curtis Martin, of Adams, Mass., S. B., Cornell University, 1898. *Geology.*

William Elejius Martin, of Havana, Ala., A. M., Southern University (Ala.), 1898. *History.*

Charles Alfred Mosemiller, of New Albany, Ind., A. B., Indiana University, 1890. *Romance Languages.*

Louis Alexander Parsons, of Burlington, Iowa, A. B., Iowa State University, 1895. *Physics.*

Israel Euclid Rabinovitch, of Baltimore. *Mathematics.*

Charles Sidney Smith, of Princeton, N. J., A. B., Princeton University, 1888. *Latin.*

Percy Goldthwaite Stiles, of Newtonville, Mass., S. B., Mass. Institute of Technology, 1897. *Physiology.*

Hopkins Scholarships

OFFERED TO VIRGINIA AND NORTH CAROLINA GRADUATES.

These scholarships, in accordance with the wishes of the founder, are awarded to candidates from Virginia and North Carolina who are considered by the Academic Council to be the "most deserving of choice because of their character and intellectual promise." The Maryland Scholarships are awarded to undergraduates.

R. M. Bird (A. B., Hampden-Sidney College, 1897), of Petersburg, Va.

I. H. Blackwell (A. B., Randolph-Macon College, 1895), of Broadrun, Va.

W. K. Boyd (A. B., Trinity College, N. C., 1897), of Durham, N. C.

J. R. C. Brown (A. B., Hampden-Sidney College, 1895), of Penn Laird, Va.

H. A. Converse (A. B., Hampden-Sidney College, 1893), of Harrisonburg, Va.

C. D. Cowles, Jr. (Guilford College, 1900), of Guilford College, N. C.

W. B. Daniel (A. M., Wake Forest College, 1892), of Wake Forest, N. C.

J. L. Davis (S. B., South Carolina College, 1897), of Asheville, N. C.

D. B. Easter (A. M., Randolph-Macon College, 1891), of Ashland, Va.

H. J. Eckenrode (A. B., Fredericksburg College, 1898), of Fredericksburg, Va.

A. W. Freeman (S. B., Richmond College, 1899), of Richmond, Va.

C. D. Harris (S. B., North Carolina Agricultural College, 1897), of Raleigh, N. C.

C. H. S. Humphreys (A. B., Emory and Henry College, 1895), of Saltville, Va.

The Johns Hopkins Press of

LIST OF SERIALS ISSUED.

American Journal of Mathematics.

is journal was commenced in 1878, under the editorial direction of ssor Sylvester. Professor Simon Newcomb is now the Editor. Twenty-olumes of about 400 pages each have been issued, and the twenty-second progress. It appears quarterly. Subscription $5 per year. Single ers $1.50. A very few complete sets remain. These will be sold for per set.

American Chemical Journal.

is journal was commenced in 1879, with Professor Ira Remsen as Editor. ty-three volumes have been issued, and the twenty-fourth is in progress. journal appears mouthly. Two volumes of six numbers and of about ages each are issued yearly. Subscription $5 per year. Single numbers nts.

American Journal of Philology.

e publication of this journal commenced in 1879, under the editorial tion of Professor Basil L. Gildersleeve. Twenty volumes of about ages each have been issued, and the twenty-first is in progress. It rs four times yearly. Subscription $3 per volume. Single numbers Sets are sold at $60 each.

Studies from the Biological Laboratory.

e publication of these papers commenced in 1879, under the direction rofessor H. Newell Martin, with the assistance of Professor W. K. ks. Five volumes of about 500 pages, octavo, and 40 plates each, have issued.

Studies in Historical and Political Science.

e publication of these papers was begun in 1882, under the editorial tion of Professor Herbert B. Adams. Seventeen series are now leted and the eighteenth series is in progress. It appears monthly. ription $3 per volume. The set of seventeen series, in cloth, will be or $51. Twenty-one extra volumes have also been issued.

Memoirs from the Biological Laboratory.

ese monographs are issued under the editorial direction of Professor iam K. Brooks. Volume IV is complete. Price of the four volumes $30.

The Johns Hopkins University Circulars.

e publication of these circulars began in December, 1879, and 146 ers have since been issued. Subscription $1 per year.

ontributions to Assyriology and Comparative Semitic Philology.

e publication of this journal was begun in 1889. Professor Paul t, of the Johns Hopkins University, and Professor Friedrich Delitzsch, University of Breslau, are the Editors. Volume IV is in progress.

The Johns Hopkins Hospital Reports.

ese Reports are edited by the Faculty of the Johns Hopkins Medical l and published for the Johns Hopkins Hospital. Their publication egun in 1890. Volume VIII is in progress. Price $5 per volume. et of eight volumes will be sold for $40.

The Johns Hopkins Hospital Bulletin.

e publication of these Bulletins began in 1889. Volume XI is in ess. They are published monthly. Subscription $1.00 per year. The ten volumes will be sold for $20.

Modern Language Notes.

This journal is edited by Professor A. Marshall Elliott and his associates in the Modern Language Department. It appears monthly. The fifteenth volume is in progress. Price $1.50 per year.

Journal of Experimental Medicine.

This journal is edited by Professor William H. Welch with the coöperation of a number of associates. It appears six times a year. Volume V is in progress. Price $5 per year. The set of four volumes will be sold for $25.

American Journal of Insanity.

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